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THE QUARTERLY REVIEW of BIOLOGY

SYMPOSIUM COMMEMORATING THE HUNDREDTH ANNIVERSARY OF THE DISCOVERY OF NEANDERTHAL MAN

I. NEANDERTHAL MAN AND THE DAWN OF HUMAN PALEONTOLOGY

BY LOREN EISELEY

Department of Anthropology, University of Pennsylvania

IF THE record of the rocks had never been, if the stones had remained closed, if the dead bones had never spoken, still man would have wondered. He would have wondered every time a black ape chattered from the trees as they do in the Celebes where, of old, simple forest people had called them ancestors of the tribe. He would have wondered when he saw the huge orangs pass in the forest, their bodies festooned with reddish hair like moss and on their faces the sad expression of a lost humanity. He would have seen, even in Europe, the mischievous fingers and half-human ways of performing monkeys. He would have felt, aloof in religious pride and the surety of revelation though he was, a vague feeling of unease. It is a troubling thing to be a man, with a very special and assured position in the cosmos, and still to feel those amused little eyes in the bush —eyes so maddeningly like our own.

Wherever man has been aware of monkeys, they have demanded explanation; without them we might regard ourselves as unique in the universe. With them appears the sole convincing evidence of man's relationship to the lowly world about him. The rumor of apes had passed far and wide even before the days of the great voyagers. Nor is it surprising to find, even in a Europe which, for over a thousand years after the Greek philosophers, eschewed the idea of organic change, that folklore and speculation arose around the living primates, so that parts of the Christian world evoked a second, a "black" creation to account for them.

In this view the Devil and his demon associates decided to attempt a creation in imitation of the work of God. When the diabolical rites were completed and the devil gazed upon the being which he had created it was found not to be human, but an ape. Great though Satan's powers were, he could not implant a soul in his abortive offspring. The ape remains, therefore, in the words of H. W. Janson (1952), a "kind of indistinct echo or reflection of man."

But whether we emphasize the tale of the black creation, or turn to various other Christian or pagan legends of differing character, we can observe one fact eternally present wherever apes are known: they are recognized as in some manner related to man, or as being deviant men or transformed men. *Naturae degenerantis homo, figura diaboli, homo sylvestris*—whatever they are named,

whatever the legend of their relationship to man, they travel down the ages with him in a companionship which is inseparable. It is as though man had a shadowy companion, a psychological Doppelgänger who had remained in the forest and yet lingered along its edge to mock his civilized brother.

His shape is confused and often seen unclearly. Sometimes it is the ape, sometimes it is an untamed wild man with a club, a lurker in woody dells and caves. Sometimes the creature moves across the modern stage in a traditional harlequin patchwork coat of leaves and tatters. Or he is the hermit with strange wisdom in a cave. He is the Abominable Snow Man whose footprints were pictured as late as yesterday's newspaper. Western civilization has never quite forgotten this hairy and primordial shadow. Compounded, perhaps, of man's suppressed subconscious longings, he is ape and man and dancing bear. He is all that remains of the lost world of the trees; of the time before the cities.

We shall see that something of this creature emerges in the early interpretations of Neanderthal man, and we shall also observe that the skull in the little cave by the Neander served as a kind of prism or lens through which passed at midcentury, a hundred years ago, a curious conglomeration of pre-Darwinian beliefs which, transmogrified and altered, entered the world of the Darwinists. Nothing, in short, so clearly reveals the transitional nature of Darwinian thinking as the treatment accorded this single human fossil. To define and evaluate the currents of thought which swirled around that heavy-browed calvarium one must examine at some little length the beliefs about man existing in the first half of the century, and then compare those beliefs with those which obtained after the publication of the *Origin of Species* and the *Descent of Man*. Strangely enough the alterations will not be as great as we commonly assume.

Space will not permit us an exhaustive pursuit of each thought element to sources in some cases more remote than the eighteenth century. For this reason we shall begin by an improvisation which may enable us to grasp quickly a key distinction between two approaches to the evolutionary problem. The one involves the comparative morphology of the living, the other the historical morphology of the dead. Both are based upon the comparative anatomy which was brought to such heights of perfection under the guidance of Cuvier.

The first used of these two methods, or ladders into the past, as we might call them, is the taxonomical approach to life which in its eighteenth century origins arose largely out of natural theology—the Scale of Nature concept which has been so extensively examined by Professor Lovejoy in his well-known book, *The Great Chain of Being* (1936).

Theologically, it was largely assumed in the eighteenth century that creation had been instantaneous, but that organisms were arranged in a continuous chain which anatomically led to man as the crowning glory of earthly life. Such views led to the search for connections, for the links between living forms. Taxonomy and comparative anatomy were, in other words, being unconsciously promoted by the religious philosophy of the times. Seeming gaps in the living scale of life were often assumed to be filled by creatures in unknown portions of the world. It was not yet clear, either geologically or paleontologically, that the world was old, or that many of its life-forms had vanished long ago; the doctrine of Special Creation held the field.

If one examines the Scale of Nature concept carefully, however, it can be observed that this linked chain of development implies a position for monkeys and anthropoid apes as standing next to man on the anatomical ladder. The only thing needed to transform the Scale of Nature idea into an evolutionary scheme is to introduce within it the conception of time in vast quantities, and the further notion that one form of life can give rise to another, that the links, in other words, are not fixed but can move their positions on the scale. This theory, the dawn of a truly evolutionary philosophy, began to come in toward the close of the eighteenth century, but its supporters constituted at that time a small and largely ignored minority.

As one examines the writings of the early evolutionists, in so far as they touch upon man, it is necessary to remember that human fossils of any sort were undiscovered, and that even the possibility that forms of life *could* become totally extinct was still under debate. It is not surprising under such circumstances that the early evolutionists tended to regard the orang as a possible existing human "ancestor" or genuine *Homo alalus* who needed only speech and the refining influence of civilization to become a man.

The higher primates, actually as yet little

studied but reported upon by the voyagers with much anthropomorphic embellishment, come close to complete humanization, only a grade below the Hottentot. African kings were said to have guards who resembled monkeys (Ritson, 1802) and, in many of the early descriptions, it is apparent that the distinction between man and ape is extremely blurred. Amongst the Australians, writes one chronicler, "there was one man who, but for the gift of speech, might very well have passed for an orangoutang. He was remarkably hairy; his arms appeared of an uncommon length; in his gait he was not perfectly upright; and his whole manner seemed to have more of the brute, and less of the human species about him than any of his countrymen. The gift of speech, however, which he must, if at all, have acquired in his infancy, will not alone prevent his actually being what he might very well have passed for." (Cited by Ritson, p. 23).

The writer, in other words, implies in this last remark that speech is an invention which could be acquired by an ape. Natives strikingly different in appearance from the white man were being arranged on a kind of evolutionary scale as intermediate links between the great apes and man. Thus, though between the first decade of the nineteenth century and the discovery of Neanderthal man in 1856, there had been a vast increase in our knowledge of the fossil past, nothing had been learned of man save the likelihood of an antiquity extending into the glacial period.

The comparative anatomy of the existing primates pointed to some close relationship with man, but it was still only possible for the evolutionist to compare living man with living ape and the living races. So far as man was concerned, the ladder into the past was still the taxonomic ladder all of whose rungs were still in existence. Important though this approach has been in revealing the secret of organic change, it is bound to be, without the checks provided by paleontology, in some degree mythological and figurative.

Lacking adequate human materials, the attention of the Darwinists was necessarily confined to the depths of the Bornean and other tropical rain forests, partly because of the known great apes that haunted their depths, but also partly because of the feeling that other more human "anthropoids," true "missing links" might still be lurking thereabouts.

A typical expression of this view actually precedes the publication of the *Origin of Species*. It occurs in Chamber's Journal in 1856 and reveals once again the popular interest in the orang (Anon., 1856). The anonymous author, after commenting that the animal may possibly be taught to speak, ventures a remark which reveals his concern with living missing links in the human phylogeny. "The Mias papan," he ventures, "may form only the external link of a chain, the other extremity of which lies hidden in the wild solitudes of Borneo." "We would therefore," he urges, "suggest to philosophers the desirableness of giving a new direction to their researches, and trying what may be done in the regions of the further east." Toward the close of the nineteenth century those regions would yield Pithecanthropus, but one hundred years ago it was still possible to seek for a living connection between man and the great anthropoids.

It may thus be seen that prior to the discovery of the Neanderthal cranium, and prior, also, to the publication of the *Origin of Species*, the rising interest in the geological history of the planet had done nothing but extend suspicions of man's antiquity and lead some individuals to anticipate a relationship between man and the great primates. If man was really an educated ape who had learned to speak and wear clothes, some degree of time must be assumed in the process, but this time element still did not seem to demand the assumption of a long chain of extinct ancestral hominids.

As evolutionary and geological speculation intensified past mid-century, Fühlrott and Schaaffhausen announced the discovery whose hundredth anniversary we are celebrating, namely, that of the first human cranium recognizable as lying outside the known limits of human variation. Schaaffhausen must be accredited with a compete recognition of the skull as "due to a natural conformation, hitherto not known to exist even in the most barbarous races" (Schaaffhausen, 1860). By a fortunate chance the discovery only slightly anticipated the publication of Darwin's and Wallace's evolutionary theories, and thus it drew more attention than would otherwise have been the case. Before long, argument would rage as to whether it was a genuine early link in the human phylogeny, yet at the time of Schaffahausen's first report it is interesting to note that he merely expressed a suspicion that the skull might represent an individual member of one of those wild northern races spoken of by the Latin writers.

So far we have spoken of the hints and intimations of human primitiveness derived from the examination of living apes and their arrangement in a sequence of stages with existing man. It is not, therefore, without interest that when a cast of the Neanderthal calvarium reached London it was exhibited between the skull of a gorilla and two negro crania. "Should this Neanderthal man prove to be an intermediate species between the Papuan and the gorilla, a great point of controversy would be gained by the transmutationists . . ." commented one observer (Blake, 1864). Another anthropologist, Pruner-Bey, did not weight the negro resemblance so highly, but was fascinated by the close resemblance of the skull to that of existing Irishmen (Blake, 1865).

"Part at least of the ancient memorials of Nature were written in a living language," Sir Charles Lyell once wisely observed. That key, that Rosetta stone to which Lyell refers is, of course, comparative anatomy. Without it we would be at a loss for a clue by which to understand the life of the past, or its relationship to ourselves. It is for this reason that Neanderthal man and his interpretation bulk so large in the mid-nineteenth century. He was, to pursue Sir Charles's simile, the first archaic human syllable caught echoing from the remoter past of man, yet still recognizably human. It was inevitable that his discovery should raise a storm of contention. Crania of similar rugosity were thought to be observed among the living peasantry of Europe, preferably among nationalities other than one's own.

There was ample justification for Virchow's remark that after the Neanderthal discovery, skulls from peat bogs, from time levels known today to be Neolithic, began to be regarded as primitive. "They smelt out," he wryly remarks, "the scent of the ape." And, further, if it was pointed out that these crania from the old pile villages were capacious and modern, some of the more rabid evolutionists contended that these people "had more interstitial tissue than is now usual, and that in spite of the size of the brain, their nerve substance may have remained at a lower stage of development" (Virchow, 1878). It was, to put the matter bluntly, a way of arguing for evolution by saying that even when ancient skulls had the appearance of *Homo sapiens* they had, to all intents and purposes, been stuffed with connective tissue, a polite euphemism for sawdust. Those who would castigate Virchow today for his opposition to the acceptance of the Neanderthal skull as a valid human fossil must remember that such excesses as represented by the above statements did nothing to increase the tolerance of the old master scientist.

Turning from the Continent to the British Isles, we may ask what views were entertained by Darwin and Huxley. Darwin, always cautious, did not express himself early. Huxley, writing to Lyell in 1862, commented that "the Neanderthal skull may be described as a slightly exaggerated modification of one of the two types (and the lower) of Australian skulls" (Huxley, 1913). Darwin, laboring upon the *Descent of Man* (1871), and drawing from Carter Blake before him, spoke of the enormous projecting canines of the La Naulette specimen. Nevertheless, he is on the whole wary, particularly because he was impressed with the capacity of the Neanderthal cranium. The Darwinians who had eyed microcephalic idiots as possible reversions to primitive man were actually not very happy or enthusiastic about the first Neanderthal discovery.

The massive supraorbital development attracted them, but the face was missing, a factor which made it impossible to be quite certain that the Neander skull was not within the variant range of the modern races. Some, like Carl Vogt (1864, p. 304), labelled the Neanderthal cranium as that of an idiot, but one has to realize that in the eyes of certain of these workers, and particularly Vogt, this does not destroy the value of the specimen as representing an early human stage of development. Instead, this theory rather cleverly evades the issue of time. It is equivalent to saying: if the specimen is old it is "normal" for its period. If it should prove to be a comparatively recent burial it is "abnormal," but a remarkable case of reversion, nevertheless, to a primitive ancestor (Eiseley, 1954).

The western world throughout the last few centuries has tended to see itself either in terms of steps going up, or steps coming down. Progress or degeneration has been a debate often influenced by the individual temperament of philosophers and perennially renewed under the impact of new systems of thought. The role played by the discovery of Neanderthal man cannot be entirely grasped without some reference to this aspect of the western mind. Under the influence of Archbishop Whately, a strong belief in the conception that modern primitives and even archeological remains of past primitives represented a state of degradation from more civilized conditions was variously expressed by numerous writers at the mid-century and beyond.

"We have found nothing yet," comments H. B. Tristram, "to prove that the barbarous dwellers on the kitchen middens were not the wandering outcasts from the pre-existent civilization of the valleys of the Euphrates or the Nile, nor is there any chronological argument against it. Nor have we yet seen the traces of the barbaric epoch underlying the vestiges of the earliest civilization in its sites. Nor in the face of the relics of the Mississippi valley, of Central America, or of Mesopotamia, can we admit that there is no evidence before us of man relapsing from civilization." (Tristram, 1866).

It would be impossible in a short space of time to explore fully the degeneration theory which, if pursued, could be shown to be related to the "Decay of Nature" concept of the Elizabethan era. As an argument to explain certain archeological facts, however, it reemerges a little prior to the publication of the *Origin of Species* and at a time when the bone caves of Europe are just beginning to be probed. The revelations of the caverns were beginning to trouble religious orthodoxy. There can be no doubt that the emergence of the "degeneration" idea was the direct attempt of the spokesman for the traditional viewpoint to explain away the crude artifacts which, when found in Europe, hinted that remote and bestial beginnings might lie at the root of western culture.

Though the argument is no longer attractive, it was a persuasive alternative to evolutionism in the mid-century decades. There were serious debates, and some of the leading scholars of the period—men like the Duke of Argyll and Sir John Lubbock—arrayed themselves on opposite sides of the question. Archeology could supply the material for debate, but the truth was that its materials lent themselves readily to either the degeneration or the development hypothesis. Rudolf Schmid (1883), a contemporary student of the period, confessed frankly that: "Archeology, as a whole, seems to do no more than admit that its results can be incorporated into the theory of an origin of the human race through gradual development, *if this theory can be shown to be correct in some other way* . . ." Schmid, in other words, recognized that something other than the approach through artifacts was needed to establish the reality of human evolution. That something was provided by the discovery of the Neanderthal skull. The skull and the La Naulette mandible of 1866 focussed attention on the fact that the bone caves might contain more than simple artifacts and evidence of extended human antiquity; they might provide conclusive proof as well that the human body itself had undergone the transfiguring touch of time.

It is true that the Darwinian passion for present-day atavisms obscured, for a time, this revelation, and that the skulls of idiots occupied on the demonstrator's platform a place between the skull of the orang and the Hottentot, but as the evidence from the caves slowly accumulated, this fashion passed. The Neanderthal discovery, coming as it did, early enough so that translations and accounts appeared in England almost simultaneously with the opening of the evolutionary debate, ensured that the skull would not be ignored nor forgotten.

For a striking new fact to receive attention, it must fit into a theory, and that theory was immediately at hand. The earlier Neanderthal discovery at Gibraltar had had no such good fortune. Schaaffhausen's remarks about the wild tribes mentioned by the Romans would be quickly forgotten by their author, nor would it matter that the Neanderthal specimen would be challenged from every conceivable point of view. The real point lay in the world-wide, if hesitant reception of the fossil, in the interest it had stirred. Out of the bones would grow a new and specialized science, and as a consequence there would occur a slow fading of the degeneration hypothesis. The discovery would lead on, also, to the truly historical morphology which Darwin and his colleagues had not yet succeeded in extricating from the comparative morphology of the living which continued in some degree to dominate their epoch and their thinking. Nor did it dominate biologists alone. As late as 1905, a prominent American anthropologist, W. J. McGee, who had charge of the anthropological exhibits at the Louisiana Purchase Exposition in St. Louis, spoke as follows: "the next physical type chosen was the Ainu . . . their small stature . . . their use of the feet as manual adjuncts, their elongated arms and incurved hands, and their facility in climbing, approximate them to the quadrumanes and betoken a tree-climbing ancestry." (McGee, 1905).

Alfred Russel Wallace would, in his emphasis upon the shift of evolution to the mind, with its enormous latent possibilities, achieve, in the end, a partially effective compromise between the degenerationists and the evolutionists, for Wallace had a foot in both camps. He would explain the apparent slowness of human evolution as then understood, and, at the same time, in his meditations over the mysterious powers of the human mind, he would go far to abandon the linear

biology which placed living races in a series of subordinate "fossil" levels, and which revolted many Christian thinkers.

If we now attempt to summarize briefly the separate elements of human thinking which were in some degree altered by the discovery at the Neanderthal cave, we may list them as follows:

First: the discovery aroused and maintained interest for a number of reasons. Anatomically, the massive character of the orbital ridges and the unusual conformation of the vault led to suspicions that its type was extinct in Europe. Also, and most importantly from the speculative standpoint, the skull came to serious attention almost simultaneously with the developing Darwinian controversy. Seized upon by some of the more avid evolutionists as a proof of man's descent from the great anthropoids, it was interpreted in terms of the taxonomical ladder which had been utilized by the transformationists of the first part of the century. Its capacious brain-case did not prevent it from being labelled as a brute, and its characters were so transformed that, without the slightest basis in fact, it was described as possessing huge projecting canines and "an appearance in the highest degree hideous and ferocious." This ferocity, of course, represents a distorted Victorian emphasis upon the struggle for existence in its more lurid forms.

Second: As the number of big-brained primitives in the upper Pleistocene became slowly established, the Darwinists were forced to reassess the time involved in the human transformation, and to extend it.

Third: The most astute researchers were led to consider the possibility that the earth, rather than the jungle or the insane hospital, might contain the clue to man's evolutionary past.

Fourth: The degeneration theory so successfully advocated by Archibishop Whately and his followers, as long as they had only the archeologist to face, began to lose its efficacy once it could be shown that the caves of Europe contained actual organic traces of men more primitive in physical type than men of the present day.

Finally, if we were to ask what lesson this discovery has to teach us today—one hundred years after the quarrymen sank their shovels in that little enclosed grotto in the gorge of the Neander—we might venture to say this: that man, irrespective of whether he is a theologian or a scientist, has a strong tendency to see what he hopes to see. The nineteenth century evolutionists—those who accepted the Neanderthal specimen—saw a savage animal whose skull contours reminded them, paradoxically, of the Negro, the Mongol, the Hottentot, or the Irishman—all peoples at that time economically depressed. The scholars tended to cling to a linear phylogenetic line in which each living race represented a frozen step on the way to the emergence of the civilized Caucasian. We smile at this today, yet it may be wondered whether our present frequent tendency to arrange our varied assemblage of human fossils in a single unilinear phylogeny may not threaten to lead to a historical simplification as rigid and potentially wrong as we now know the unilinear taxonomical approach through the living races to have been. After all, we know paleontologically that families have proliferated and later contracted as a single type has achieved ecological dominance.

In conclusion, when we consider this creature of "brute benightedness" and "gorilloid ferocity," as most of those who peered into that dark skull vault chose to interpret what they saw there, let us remember what was finally revealed at the little French cave near La Chapelle aux Saints in 1908. Here, across millennia of time, we can observe a very moving spectacle. For these men whose brains were locked in a skull reminiscent of the ape, these men whom serious scientists had contended to possess no thoughts beyond those of the brute had laid down their dead in grief.

Massive flint-hardened hands had shaped a sepulchre and placed flat stones to guard the dead man's head. A haunch of meat had been left to aid the dead man's journey. Worked flints, a little treasure of the human dawn, had been poured lovingly into the grave. And down the untold centuries the message has come without words: "We too were human, we too suffered, we too believed that the grave is not the end. We too, whose faces affright you now, knew human agony and human love."

It is important to consider that across fifty thousand years nothing has changed or altered in that act. It is the human gesture by which we know a man though he looks out upon us under a brow suggestive of the ape. If, in another fifty thousand years, man can still weep, we will know humanity is safe. This is all we need to ask about the onrush of the scientific age.

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II. THE EVOLUTIONARY SIGNIFICANCE OF VARIATION AND VARIETIES OF "NEANDERTHAL" MAN

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A HUNDRED years ago, in August, 1856, Johann Carl Fuhlrott, then a professor at the Realschule in Elberfeld (Germany), was given fourteen pieces of a human skeleton encountered by workmen during the removal of deposits of earth accumulated in the Feldhofer Cave (Fuhlrott, 1859, 1865; Bürger, 1956). The cave was situated in the steep limestone cliffs of the gorge of the Neander valley, some sixty feet above the small stream of Düssel, eleven kilometers east of Düsseldorf. The gorge, and the valley to the north, named for the German Reformed Church composer and poet Joachim Neander (1650–1680), had long been a favored spot for week-end outings, and excursionists were provided with a charming booklet which described its scenic beauties and local natural history (Bongard, 1835). Since 1921 it has been a monument under the protection of the Naturschutzvereins Neandertal (Gross, 1956a); the cave has long since disappeared through limestone quarrying activities.

The controversy which arose after Schaaffhausen's (1858; also 1888) description of the human remains, particularly after it was translated by George Busk and published in English (1861), is well known (Gruber, 1948; Narr and von Uslar, 1956). There were those workers, like Schaaffhausen and Huxley (1864) who recognized the skeleton to be that of a normal human individual, although of an ancient variety. King (1864), although he subsequently changed his mind, thought it was less closely related to modern man and introduced the specific designation, *Homo neanderthalensis*. Others, like Blake (1864), Mayer (1864), and Virchow (1872), were convinced that its special morphology was pathological and due in particular to rickets. Subsequent discoveries, especially those in Belgium at the cave of Spy (Fraipont and Lohest, 1887) and in southern France at the cave of La Chapelle-aux-Saints (Boule, 1911–13) and the shelter of La Ferrassie (Capitan and Peyrony, 1909–1912; Peyrony, 1934) fully confirmed the normalcy of this human variety whose distinctiveness was a phylogenetic rather than a pathologic phenomenon.

It is in general true that most workers of the last century who were interested in the skeletal remains of early man were primarily concerned with the Neanderthal remains as representative of a link intermediate between living men and the recent African apes. Before, and even for some considerable time after the Neanderthal discovery there was preoccupation with a sort of horizontal hierarchial arrangement of living human groups as a spectrum from least to most "primitive," the latter approximating most closely to the living pongids. With the dearth of fossil human skeletal remains, and an inadequate knowledge of Pleistocene stratigraphy and time, it was impossible then to appreciate the evolutionary significance of these earlier human discoveries. The fact that there was a lack of fossil animal or cultural associations in the case of the type specimen from the Neander gorge served only to confuse and obscure the situation. With increasing knowledge of the geological age and geographical distributions of the various Neanderthal peoples, and the recovery of fossil human remains from earlier and later horizons, it is possible at last to assess more adequately their evolutionary importance.

The term "Neanderthal" has been greatly extended beyond its initial usage. It pertained originally only to the type specimen and came to be firmly established as a designation for a certain extinct variety of man. It received a temporal connotation only with the recovery of the two human burials in the cave of Spy which were associated with a so-called cold or subarctic fauna comprising a number of extinct species (or forms

no longer found in the region). As discoveries multiplied in future years the term was applied to human remains from regions outside of western Europe and from earlier geologic horizons. It has been applied loosely to fossil human remains from western Asia and northern Africa, and even the tropics and subtropics of the southern hemisphere of the Old World! The practice has shown no signs of passing out of fancy. It has been particularly unfortunate since it has tended to categorize certain Pleistocene hominids so that posing meaningful inquiries as to their affinities and phylogenetic significance was automatically precluded. In fact, the first step in this direction was taken by King when he introduced a specific designation, *neanderthalensis*, for the skeleton from the cave in the Neander gorge.

One result has been the growth of a great controversy, still very much alive, as to whether there might have been a "Neanderthal" phase or stage in the evolution of modern man. This view was strongly supported by Hrdlička (1927, 1930) and Weidenreich (1928a, 1940, 1943), to mention only two that are well known. Unfortunately, this point of view has still to be meaningfully expressed in terms of modern evolutionary theory. Opponents of this viewpoint have argued that "Neanderthals," broadly speaking, were merely an evolutionary blind-alley, a divergent offshoot in man's phylogenetic history with its roots far back in the Pleistocene (Boule, 1921; Vallois, 1954). The use of the appellation "Neanderthal" for a fossil hominid would thus automatically exclude the human remains in question from having any direct evolutionary significance for modern human origins.

Actually, this too simple dichotomy is no longer either useful or attractive, in view of present understanding of the hominid fossil record. It is no longer necessary to think of simple morphological stages of human evolution during the earlier Upper Pleistocene, as has been done commonly in the past. There is now sufficient fossil evidence from clearly defined time levels, to permit some observations on samples of human populations from circumscribed geographic regions of the European and western Asian continental land mass. An attempt will be made here to outline the major aspects of the Neanderthal problem on the basis of present paleoanthropological knowledge, with particular reference to the question of variation and varieties within the peoples called Neanderthal.

EARLY NEANDERTHALS

The first peoples who are recognizably Neanderthals have been found in the earliest stage of the Upper Pleistocene, the Last Interglacial (Eemian = Riss/Würm). Their distribution seems to have been exclusively (or at least primarily) Eurasian, extending from south-central and western Asia into, and throughout, Europe. The human skeletal remains available from this time are, however, both scant and quite scattered over this area. With the exception of one site (Krapina) there is no adequate series of specimens from any single locality; morphological studies must be based of necessity not only on fragmentary remains, but often poor preservation of a single individual. What is available to the human paleontologist is a glimpse of segments of early Neanderthal populations from southern Uzbekistan (Teshik-Tash), Palestine (et-Tabūn Eb, probably ez-Zuttiyeh), Croatia (Krapina), Slovakia (Ganovcé), Thuringia (Ehringsdorf), and western-central Italy (Saccopastore).

Mediterranean Africa is still too poorly known to permit an assessment of its racial composition at this time. However, it seems very likely from other paleoanthropological and mammalian paleontological evidence that some variety of (early) Neanderthal peoples also occupied that area.

Two sites in Mediterranean Africa have yielded skeletal remains attributed to "Neanderthal" man. These are: Haua Fteah in Cyrenaican Libya (McBurney, Trevor, and Wells, 1951) and the Mugharet el-Aliya (Tangier, Morocco) (Senyürek, 1940); in both instances the remains were associated with a Mousterian industry of Levallois facies. The remains, consisting of upper and lower jaw fragments, are too incomplete to determine certainly the affinities of these North African prehistoric peoples; they would seem to have been with the broadly contemporaneous southwest Asian Neanderthals.

The area south of the Sahara seems to have been racially distinct, judging from the somewhat younger human skeletal remains from the sites of Eyasi, Broken Hill, Saldanha, and Florisbad. Thus, Neanderthal penetration did not pass south of the Sahara Desert. This was surely an effective barrier to early man during the Last Interpluvial (Interglacial) stage, although probably much less of a barrier during the Penultimate and Last Pluvial (Glacial) stages.

The origins of these early Neanderthal peoples

are still completely obscure. It is not yet possible to ascertain (1) whether they were new occupants of the European continent, spreading northward and westward from southern and western Asia, perhaps as a result of the major amelioration of glacial climate at the end of the Middle Pleistocene, or (2) whether they represented an indigenous development within the European continent. The problem of origins cannot be settled until something more is known of the peoples of the European Third Glacial stage. It is altogether possible that the human mandible from Montmaurin (Haute-Garonne) (Vallois, 1955, 1956a), as well as the cranial fragments from Fontéchevade (Charente) (Vallois, 1949), derive from this time; however, both are commonly regarded as of Last Interglacial date. The cranial morphology of the peoples of the preceding Great Interglacial stage is now fairly well known from the remains discovered in central and western Europe, at Steinheim (Berckhemer, 1933, 1936) and Swanscombe (Morant, 1938), and in the Maghreb of northwest Africa, at Ternifine (Arambourg, 1955, 1956); there are also the slightly younger remains, dated to the base of the Penultimate Pluvial, from Rabat (Vallois, 1945; Briggs, 1948) and Sidi Abderrahman (Arambourg and Biberson, 1956). There is little indication of specifically Neanderthal morphology in any of these specimens. The masticatory apparatus, both mandible and dentition, was quite primitive, judging from the remains from the Maghreb (and the Montmaurin mandible), while the occipital area of the cranial vault was fundamentally more modern in its morphology. It is altogether likely, however, that important human evolutionary changes were taking place during the Penultimate Glacial stage. A major advance could be made towards a solution of the problem of Neanderthal origins with the discovery of adequate skeletal remains from this time level.

Only the cranial morphology of the early Neanderthals of Europe is fairly well known, on the basis of the two Saccopastore skulls (Sergi, 1944, 1948a) and the series of broken and mutilated specimens from Krapina (Gorjanović-Kramberger, 1906). Another fairly complete cranium (No. 3) from Kaempfer's Quarry, Ehringsdorf (Thuringia) was somewhat inaccurately restored by Weidenreich (1928b); Kleinschmidt (1931) made a more correct restoration which clearly reveals the basic similarity to the specimens from Saccopastore. The series from Krapina, as well as earlier discoveries (Nos. 1, 2) at Ehringsdorf (Virchow, 1920) include not only specimens of the adult jaws and dentition, but juvenile cranial and mandibular fragments which permit some inferences on early Neanderthal growth and maturation. There are fairly numerous, but incomplete postcranial fragments from Krapina, an incomplete femur from et-Tabūn Eb (Mount Carmel) (McCown and Keith, 1939), and juvenile postcranial fragments (which are largely useless) from Ehringsdorf (No. 2) and Teshik-Tash (Sinel'nikov and Gremiatskii, 1949). However, the postcranial skeleton of these peoples is still really very poorly known.

These peoples differed in cranial morphology from the succeeding classic Neanderthals in a number of features. The most important are: (1) smaller cranial capacities, (2) shorter cranial lengths and narrower widths, (3) more highly arched vaults and expanded occipital bones with a tendency to produce an external occipital protuberance associated with a small occipital torus, (4) a tympanic plate with more vertically oriented anterior portion and less robust posterior portion, (5) shorter and more flexed cranial bases, (6) smaller facial skeletons, (7) suprafacial toral structures tending to separate into medial and lateral elements, and (8) more antero-lateral orientation of malar bones, with clear demarcation between malar and maxilla, and tendency for depression of the supracanine region (canine fossa formation) (cf. Howell, 1951). The postcranial skeleton exhibits features which are in general more anatomically modern than was the case in the distinctive classic Neanderthal group. Thus, the long bones were relatively more gracile, the humerus relatively straight, the radius only slightly curved (but with the long neck and backward situated bicipital tuberosity of the classic Neanderthals), the ulna quite straight and slender (but with the enlargement of the olecranon incipiently classic Neanderthal), and the femur with relatively straight shaft, moderate subtrochanteric flattening, and lack of enlarged extremities. Similarly, the characteristic morphology of the axillary border of the scapula was not typically of the classic Neanderthal variety (with its prominent dorsal sulcus and pronounced axillary crest), although there was already an approach to this form in some Krapina specimens (Gorjanović-Kramberger, 1914, 1927).

Many features of early Neanderthal morphology,

both cranial and postcranial, are incipiently classic Neanderthal. However, the general morphological pattern of these early Neanderthal peoples bore a close resemblance to that of anatomically modern man, a fact which indicates again the special character of classic Neanderthal morphology. Actually this is not altogether unexpected, at least in Europe, if consideration is given to the peoples of the Great Interglacial stage, as represented by the Steinheim and Swanscombe remains. These specimens illustrate very clearly that the still small-brained handaxe-making peoples of that time had already approached a basically modern morphological pattern in certain features of the braincase (and middle face), although the masticatory skeleton (and related anterior region of the vault) was still somewhat primitive. [This is equally true for the child from Teshik-Tash which, according to the careful description of Gremiatskii (1949), is considerably less anatomically modern than Weidenreich (1945; also Howell, 1951) first suggested.] The evidence would now seem to indicate that "neanderthalization," if one may use this phrase, was a continuing and strictly European phenomenon.

CLASSIC NEANDERTHALS

Our knowledge of human races and their distributions in Eurasia during the initial part of the Last Glacial stage is considerably better than for the preceding interglacial. However, fossil samples of such populations are still relatively small, except for southwestern Europe and the Levant coast. Nevertheless, an examination of the evidence at hand reveals quite clearly differences in skeletal morphology between southwestern Europe on the one hand, and eastern Europe and western Asia on the other.

The people who occupied the western and southern parts of Europe during the earlier phase of the Last Glaciation have been termed classic Neanderthals. The holotype for the population is the partial skeleton found in 1856 in the Feldhofer cave in the Neander gorge. Two other specimens attributable to the group, an adult skull from Forbes Quarry (Gibraltar) and a child's skull from the cave of Engis (Belgium), were found earlier and went unrecognized for some years until the discovery at the Neanderthal proper. This group is well known from a number of specimens from western Ger-

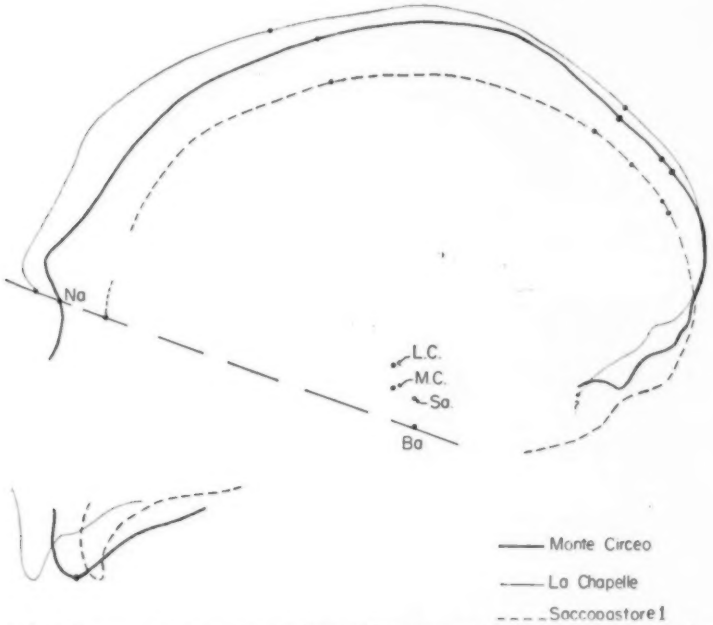

FIG. 1. MID-SAGITTAL CRANIOGRAMS OF EARLY NEANDERTHAL (SACCOPASTORE 1) AND CLASSIC NEANDERTHAL (LA CHAPELLE, MONTE CIRCEO) SKULLS

many, Belgium, southern France, Spain, and western Italy.

Sites which have yielded classic Neanderthal skeletal remains are: *Germany:* Neanderthal; *Belgium:* Bay-Bonnet, Engis, La Naulette, Spy; *Channel Islands:* St. Brelade (Jersey); *France:* Malarnaud (Ariège); La Chaise, La Quina, Petit-Puymoyen (Charente); La Chapelle-aux-Saints (Correze); Genay (Côte d'Or); Combe Grenal, La Ferrassie, Le Moustier, Pech de l'Azé (Dordogne); Monsempron (Lot-et-Garonne); Hyena and Wolf Caves, Arcy-sur-Cure (Yonne); *Spain:* Bañolas, Cova Negra, Gibraltar (Forbes Quarry, Devil's Tower), Piñar; *Italy:* Fossellone and Guattari Caves (Monte Circeo), Santa Croce di Bisceglie.

The classic Neanderthals differed from the early Neanderthals in a number of aspects of cranial morphology, both in the braincase and the facial skeleton. The classic Neanderthals were characterized by: larger brains; long, low, and wide cranial vaults with a high frequency of postlambdoidal flattening (due to the pattern of growth and closure of this suture); less flexed cranial bases (Fig. 1); more sharply angulated occipital bones with relatively heavier occipital tori; more horizontal orientation of the tympanic plate with heavy anterior and posterior portions; larger facial skeletons (large, round orbits, large nasal aperture, marked interorbital space); semicircular supraorbital tori with fused medial and lateral elements; and shelving of maxilla into malar, with no demarcation between these bones, a convergence of the maxillary walls, and lack of supracanine hollowing (canine depression) (Fig. 2).

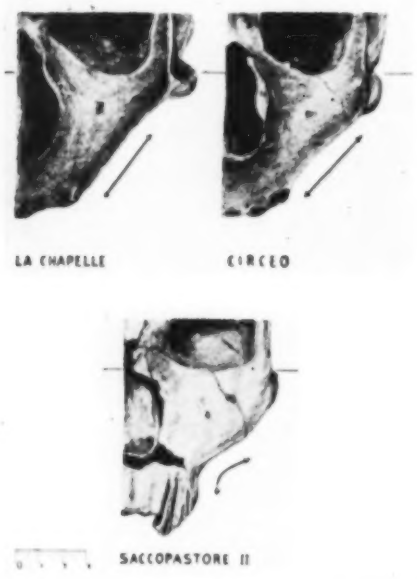

FIG. 2. STRUCTURE OF THE MID-FACIAL REGION IN EARLY NEANDERTHAL (SACCOPASTORE II) AND CLASSIC NEANDERTHAL (LA CHAPELLE, MONTE CIRCEO) PEOPLES
After Sergi, 1948b.

This distinctive cranial morphology of the classic Neanderthals was the result of a characteristic pattern of ontogenetic development and growth. This pattern can be analyzed in some detail, since infant (*Pech de l'Azé*: Patte, 1956, 1957), child (*Gibraltar 2:* Buxton, 1928; *La Quina 18:* Martin, 1926), and adolescent (*Le Moustier:* Weinert, 1925) individuals provide a fair cross-sectional series for comparison with adults. Fortunately, a well-preserved early Neanderthal child's cranium (*Teshik-Tash:* Gremiatskii, 1949) is known, and it reveals a quite distinctive morphology when compared with a classic Neanderthal child (*La Quina 18*) of similar dental age (Fig. 3). An eastern European Neanderthal child (*Subalyuk:* Bartucz et al., 1938), contemporaneous with the classic Neanderthals of western Europe, bears a closer morphological similarity to the early Neanderthal from Teshik-Tash than to the classic Neanderthal variety. This is a point of considerable importance in understanding the evolutionary origin and significance of the classic Neanderthal peoples.

The classic Neanderthal adult postcranial skeleton is quite well known from a series of seven partially preserved individuals (La Chapelle, La Ferrassie 1, 2, La Quina 5, Spy 1, 2, and the type Neanderthal remains) from five sites; the adolescent skeleton is represented by a young male from Le Moustier. Since the early Neanderthals are known largely only by their skulls and dentition, the Krapina remains being the exception, it is difficult to make comparisons of the postcranial skeleton with the classic Neanderthal group. The Krapina series would suggest that there were certain slight differences, but it must be remembered that no early Neanderthal postcranial remains are known from southwestern Europe. At any rate the differences are probably no more than those between distinctive modern human populations. The classic Neanderthals did differ in postcranial morphology from anatomically modern populations but, as Patte (1955) has very clearly demonstrated in his excellent synthesis of the

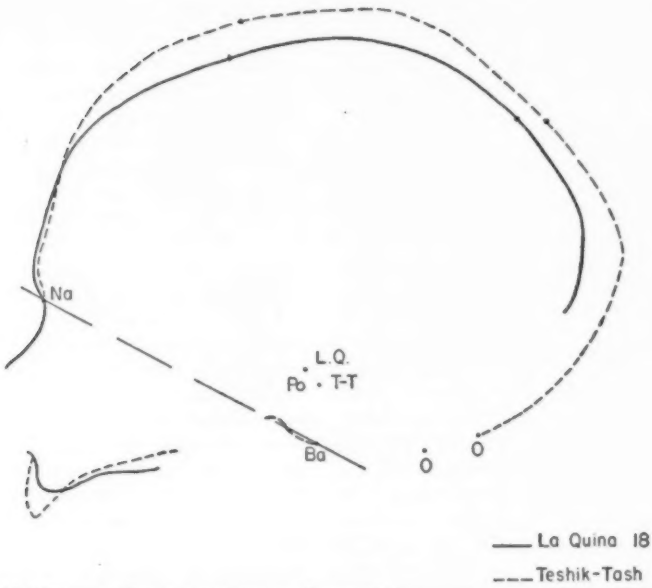

FIG. 3. MID-SAGITTAL CRANIOGRAMS OF AN EARLY NEANDERTHAL CHILD (TESHIK-TASH) FROM CENTRAL ASIA AND OF A WEST EUROPEAN CLASSIC NEANDERTHAL CHILD (LA QUINA 18), BOTH OF THE SAME DENTAL AGE

comparative data, these differences were much less marked than some writers in the past have been led to believe. Moreover, and contrary to the conclusions of some earlier workers, the classic Neanderthal postcranial skeleton is basically modern human in over-all morphology; it bears no phylogenetically significant resemblance to that of the non-hominid higher primates. Such features were stressed by Boule (1911–13) in his description of the "old man" (actually probably under 40 years of age! cf. Vallois, 1937) of La Chapelle-aux-Saints, but Schwalbe (1914) and others have shown that this interpretation is untenable.

The classic Neanderthals were fairly short, stout, and powerfully built people. Some of the especially interesting and characteristic features of their postcranial skeleton are: generally low vertebral bodies with large transverse and spinous processes; a broad upper thorax; a long, fairly slender, well-curved clavicle with large articular extremities; scapula with a prominent dorsal crest on the axillary border and a well-developed dorsal marginal sulcus, and a prominent upwardly inclined scapular spine with large rounded notch; a relatively short, but robust humerus with prominent muscular insertion areas, large head and distal extremity, weak humeral torsion, large epitrochlea and paratrochlear crest, and a large condylo-diaphysial angle; a relatively low (70.–76.) antibrachial (radio/humeral) index; a short, robust forearm with rather high arm (humerus/ulna) angle, marked (radius) to considerable (ulna) curvature, large proximal and distal extremities, radius with great relative length of neck and distal situation of salient bicipital tuberosity, marked proximal flattening (platolenia) of the ulnar diaphysis, marked height of the olecranon and large, sloping coronoid process; a hand with robust, large-headed metacarpals and short phalanges; very massive femora with slight to very pronounced shaft curvature, no pilaster and only slight to absent linea aspera, considerable platymeria, low angulation and little flattening of the neck, very large head (compared to physiologic length) and greater trochanter, frequent development of a third trochanter and hypochanteric fossa, large distal extremity (compared to physiologic length) with broad, deep patellar fossa, condyles usually of about the same size or with the external *smaller* than the internal; a very low (74.–79.) crural (tibio/femoral) index; a very robust, eurycnemic tibia, large proximal extremity with retroverted

tibial plateau, straight or slightly concave surface of the lateral condyle, large distal extremity, quite straight angle of the articular surface for the astragalus, high frequency of (external) squatting facets; very robust, curved fibula with large extremities and subcylindrical (rather than fluted) shaft form; a large, broad, and high astragalus with short head and neck, quite marked deviation of the talar head, long trochlea with large posterior compared to anterior breadth, high frequency of trochlear squatting facets, very broad and obliquely situated internal malleolar facet which is larger than the external facet; a large (broad and long), massive calcaneus with very long heel; and very robust metatarsals, very thick and short phalanges.

Where there is sufficient evidence to permit accurate relative dating (as there is at a considerable number of occupation and burial sites) it has been established that the classic Neanderthals were confined to the initial damp and cold phase of the Last Glacial stage (= Early Würm of Woldstedt, 1956), i.e., throughout the time of the accumulation of the first two Recent Loesses of the western European succession. For reasons still unknown, the group disappeared completely from the record sometime during the subsequent, major (Göttweiger or Fellabrunner) interstadial phase. At this time anatomically modern peoples of the Cro-Magnon variety, with a quite different stone-working technique (punched blades and the prismatic core) and tool-kit, penetrated into westernmost Europe from regions farther eastward, probably the hilly country of southeastern Europe. Some workers, for example Zeuner (1956), have maintained that at some sites (St. Pierre les Elbeuf on the Somme River, Grotte Guattari at Monte Circeo) there is evidence of classic Neanderthal survival throughout this interstadial phase and even into the subsequent cold stadial (= Main Würm of Woldstedt, 1956). However, in the case of the loess sections there is no evidence to support this inference, since Upper Paleolithic blade-tool industries clearly appear toward the close of the interstadial and are exclusively present in the subsequent Main Würm stadial, the time of the western European Aurignacian (Bordes, 1954). Thus, it is possible to establish the time of classic Neanderthal disappearance quite closely, although the cause or causes for such disappearance is still a hotly argued issue in paleoanthropology. There is no clear-cut evidence which would indicate that the classic Neanderthals either (1) lived contemporaneously with the earliest of the Cro-Magnon people (who were probably responsible for the Chatelperronian industry) or (2) that they interbred with the latter people. However, both possibilities have been suggested by some workers.

The classic Neanderthals were apparently restricted in distribution only to southwestern Europe. The main centers of occupation were the sheltered and well-watered valleys of southern France and similar parts of the Iberian and Apennine peninsulas. These were regions outside the main periglacial zone of permanently frozen ground and tundra vegetation (Büdel, 1949a, b). It is well established, however, that there was at least sporadic classic Neanderthal penetration, perhaps seasonally for hunting and collecting purposes (and with attendant alterations in tools and techniques of manufacture), into adjacent, more northerly parts (including southern Belgium, northern France, and the Rhineland). Such penetration probably took place during the (two) more humid and cool phases of climate which preceded the very windy and dry maxima of the Early Last Glacial when the first two Recent Loesses were accumulated. There is no evidence of human occupation in the loesses proper (cf. Bordes, 1954) when those zones supported only an herbaceous vegetation with sparse dwarf trees and bushes of the subarctic variety and a fauna comprising largely steppe rodents and the like.

There remains the question of whether classic Neanderthals also occupied the Alpine forelands of central Europe and the regions farther to the east. The question is still difficult to answer. The foreland region has failed to provide human skeletal remains in association with the local Mousterian industry (often an Almühlian facies with fine leaf-shaped points). There are Mousterian sites in the limestone hills (Jura) of southern Württemberg and Bayern, but they are far from common and, in fact, date largely from the end of the Early Last Glacial into the main interstadial. Human occupation would appear to have been uncommon and sporadic here during the early stadial phase (Howell, 1952); and there is no evidence that *classic* Neanderthals occupied the region.

Mousterian sites are only rarely present in the open loess lands of the Danubian basin and, more commonly, in the hilly country of Moravia and Slovakia (including the adjoining Bükk mountains to the south) and the foothills of the Carpathian chain. There are special facies of the Mousterian

industry in this easterly region, but these are still rather poorly known and have not been compared with those of other regions. Human skeletal remains, usually referred to a Neanderthal people, have been recovered from two sites in this easterly area, Šipka cave in northern Moravia (Schaaffhausen, 1882; Virchow, 1892) and Subalyuk cave in the Bükk mountains (Hungary) (Bartucz et al., 1938; Szabo, 1935). Both sites date from the Early Last Glacial.

Mottl (1938, 1941) has suggested that the Subalyuk remains date from the later part of the Last Interglacial stage. However, and as Gross (1956b) has also noted, both the faunal and the stratigraphic evidence (as well as the associated late Mousterian industry) testify to the steppe conditions which prevailed in this region in the Early Last Glacial.

The nature and preservation of the skeletal material leaves much to be desired, but the morphological evidence seems to suggest that the peoples were not classic Neanderthals. Instead they resembled more closely the early Neanderthals of the preceding interglacial. Apparently early Neanderthal peoples persisted, both in eastern Europe and southwestern Asia, into the Early Last Glacial (Pluvial).

East-central and eastern Europe were not particularly isolated during the Early Last Glacial. Most of the plains and low country were steppe lands which supported a rich grazing fauna (fully exploited by the subsequent Upper Paleolithic peoples); hilly regions and enclosed valleys were largely wooded (Wilhelmy, 1950). There were no major natural obstacles, climatic or otherwise, to prevent population shifts as bands moved from territory to territory, nor to hinder free genetic interchange over this region, the regions bordering the Black Sea and southwestern Asia. It would seem that there was broad racial continuity at least as far east as the Crimea and southward into the Levant. This is suggested by Neanderthal remains from the site of Kiik-Koba (Bonch-Osmolovskii, 1940, 1941, 1954) and those from the site of et-Tabūn (Mount Carmel) (McCown and Keith, 1939).

The European early Neanderthal remains, although not numerous and far from well preserved, suggest very strongly that the distinctive classic Neanderthal skeletal morphology had its roots in the Last Interglacial. The evidence would seem to indicate, as the writer has concluded elsewhere, that the classic Neanderthals were a final local evolutionary development in the western European *cul-de-sac* (Howell, 1951, 1952; cf. Heberer, 1944). The field evidence also suggests that a discontinuity in human distribution was very likely present through the central European periglacial corridor. This discontinuity would have had a profound effect in terms of gene flow, since western and southern Europe would have constituted circumscribed breeding areas for Neanderthal peoples. The classic Neanderthals would thus have become a stabilized variety only during the initial phase of the Last Glacial, due to isolation and perhaps in response to the imposed rigors of a harsh subarctic climate imposing severe selective pressures.

SOUTHWEST ASIAN NEANDERTHALS

Seven sites in five southwest Asian localities have yielded human skeletal remains which have been attributed to a variety of Neanderthal man.

Southwest Asian sites which have yielded remains attributed to a variety of "Neanderthal" man are: (1) M. ez-Zuttiyeh, a cave near the northern shore of the Sea of Galilee (Turville-Petre, 1927); (2) M. et-Tabūn, a cave, and (3) M. es-Skhūl, a rock shelter, both in the Wadi el-Mughara on the western slopes of Mount Carmel (Garrod and Bate, 1937; McCown and Keith, 1939); (4) Shukbah, a cave in the Wadi en-Natuf, northwest of Jerusalem (Keith, 1931); (5) Djebel Qafzeh, a cave in Galilee, south of Nazareth (Köppel, 1935; Neuville, 1951; Boule and Vallois, 1952); (6) Shanidar, a cave in southern Kurdistan (Solecki, 1956; Senyürek, 1956); (7) Bisitun, a cave near Kermanshah in western Iran (Coon, 1951). Since this was written further adult skeletons have been found by Ralph Solecki in Shanidâr cave during the 1957 season.

In all cases (save perhaps that of the specimen from M. ez-Zuttiyeh, see below) these were associated with a local Mousterian industry of Levallois facies (Howell, in litt.). The best known of these, from the caves on the Mount Carmel, have had a very mixed reception by students of human paleontology. Paleoanthropologists have failed to reach a reasonable consensus as to their affinities with the several sorts of European Neanderthal people, and there is not yet any agreement as to their broader phylogenetic significance.

This lack of agreement has been due to some extent to misunderstandings as to the relative geological age of the so-callled Levalloiso-Mousterian industry (and associated fossil men) in this area. At Mount Carmel the remains from et-

Tabūn (level C) and es-Skhūl (level B) were assumed by McCown and Keith (1939) to be "contemporaneous in a moderately narrow sense" and thus to represent a single variable population. These prehistoric people were presumed to date from the closing phases of a dry and warm interpluvial which was considered to correspond to the European Last Interglacial stage (Garrod and Bate, 1937; Zeuner, 1938, 1945, 1952). Thus, the Mount Carmel people would have been broadly contemporaneous with the European early Neanderthals. This conclusion is not supported by the field evidence, however. A careful examination of the stratigraphic and faunal data (Howell, 1957, in litt.) leaves no doubt that the human skeletal remains are of Early Last Pluvial age. Other Levant Levalloiso-Mousterian sites with human skeletal remains (ez-Zuttiyeh probably excepted) are of the same age. Thus, these Neanderthal peoples were not contemporaneous with early Neanderthals, but with the classic Neanderthals of southwestern Europe. The relative age of the southwest Asian Neanderthals is a matter of considerable consequence in understanding their phylogenetic significance.

Three major interpretations of their evolutionary significance have been offered. McCown and Keith (1939) concluded that at Mount Carmel there were the "remains of a single people, the Skhūl and Tabūn types being but the extremes of the same series, there being intermediates between the extremes." This was due, in their opinion, to "an evolutionary divergence," since the Mount Carmel people "were in the throes of evolutionary change." Although these authors found the people from the shelter of Skhūl to bear a closer resemblance to the Cro-Magnon people of the European Upper Paleolithic, the former were not, in their opinion, directly ancestral to these anatomically modern men ("the Mount Carmel people are not the actual ancestors of the Cromagnons but Neanderthaloid collaterals or cousins of the ancestors of that type"). [This conclusion, which has not been entirely clear to some workers (including the writer), is clarified by Keith's (1948) remark that he and McCown believed "that at the period earlier than that represented by the fossil Carmelites, and farther towards the east, a local group of Neanderthalians began to evolve in a Caucasian direction and that these Carmelites represent a later phase of this movement."]

This interpretation has been opposed by some other workers. Ashley Montagu (1940; also, 1951) was the first to offer hybridization as an alternative explanation, one which McCown and Keith had indeed considered but rejected. He was convinced that "any other theory would have to assume the spontaneous mutation of far too many genes, or far too great a change in gene variability, to render such a theory tenable." Hooton (1946) agreed with this conclusion, finding McCown's and Keith's interpretation "both ambivalent and ambiguous," and lent his support to this alternative hypothesis. Dobzhansky (1944) added the weight of a geneticist when he stated that the Mount Carmel population was "a result of hybridization of a Neanderthaloid and a modern type, these types having formed earlier in different geographic regions." This proved, in his opinion, that "the Neanderthal and the modern types were not isolated reproductively, and hence, were races of the same species rather than distinct species." Most recently Weckler (1954) has attempted to extend this interpretation into a broad (but far-fetched!) explanation of human evolution in the Pleistocene.

Both the theory of evolutionary divergence (as framed by McCown and Keith) as well as that of hybridization have recently been rejected by Le Gros Clark (1955). He has suggested that the people of the Mount Carmel caves "appear to represent a transitional stage leading from pre-Mousterian *Homo sapiens* to the later establishment of the definitive species *H. neanderthalensis*." This conclusion would seem to imply that all European Neanderthals of the Last Interglacial, and southwest Asian Neanderthals of the subsequent Early Last Pluvial, constituted merely an incipient stage in a unilinear Neanderthal development, terminated by an aberrant and specialized paleospecies which failed to survive the Early Last Glacial.

These divergent opinions reflect the uncertainty (and misunderstanding) which surrounds the people of the southwest Asian Mousterian. The problem is seriously in need of reexamination and, as has been pointed out elsewhere (Howell, 1957), an alternative explanation will also fit the facts. Several matters can probably be resolved only by the discovery in the Levant of additional human skeletal remains in a stratified series of Mousterian occupation levels. It would be especially useful if additional remains were to be found with an Acheulian of Yabrudian facies (ex-Micoquian), like that in et-Tabūn level E, and with a Mousterian of

Yabrudian facies, like that present at Yabrud (Shelter I) on the slopes of the Anti-Lebanon mountains (Rust, 1950). In both cases, but at different time levels, there is evidence of what might have been extraneous cultural influences penetrating into this region from a still unknown source and responsible for the introduction of an Upper Paleolithic blade-tool typology (Howell, in litt.). It seems very likely to the writer that important structural changes were taking place in human populations of the Levant during the Early Last Pluvial. These were of primary significance for the evolutionary origin of subsequent anatomically modern peoples of the European Upper Paleolithic.

Early Neanderthal peoples, not unlike those from Europe (Ehringsdorf, Krapina), were probably present in the Levant as early as the Last Interpluvial (Interglacial). This conclusion is founded on very tenuous evidence: an incomplete shaft of a femur (level Ea) and an isolated, worn lower right molar (level Eb) from the rich Acheulian of Yabrudian facies occupation zone in the cave of et-Tabūn at Mount Carmel. These people also resembled the succeeding inhabitants of the cave responsible for the Mousterian of Levallois facies industry (level C). The cranio-facial fragment from ez-Zuttiyeh (Galilee) offers more substantial evidence. These remains are usually assumed to have been associated with a Mousterian industry of Levallois facies, but Garrod (Garrod and Bate, 1937) has directed attention to the fact that they derived from the basal occupation zone of the site where hand-axes, suggestive of an Acheulian of Yabrudian facies industry, were present. In his original description of the specimen Keith (1927) found "details in which the Galilean type differs from the Neanderthal varieties which have been discovered in Europe hitherto"; but, at the time, he was reluctant to decide on the basis of the material available whether these were of racial significance or merely individual variation. Subsequently, Keith (1931) affirmed that "the ancient Galilean was not the pure Neanderthal type, but a variant of the type . . . ." This specimen, as McCown and Keith (1939) have shown, closely resembled the skeletal remains from the Mousterian of Levallois facies horizon (level C) at et-Tabūn.

Aside from a nearly complete (female) skeleton, this level (C) yielded only another isolated (male) mandible and five other small portions of the upper and lower limbs of further individuals. These remains, not sufficiently numerous to reveal the range of variation of the population which they represent, closely resembled the European early Neanderthals. They differed markedly, both in cranial and postcranial morphology, from the classic Neanderthal peoples of western Europe. As in the case of European early Neanderthals, there were a number of features which approached and even at times duplicated the morphology of anatomically modern man.

Keith and McCown (1937) were first led to distinguish two distinct morphological "types" in the human remains from the sites in the Wadi el-Mughara: the "Skhūl type," a majority of whose features were "those which we find in the modern races of man, the native races especially"; and the "Tabūn type," which although having an "undoubted kinship with the Skhūl type of humanity," was basically "Neanderthaloid" and "more akin to the Krapina Neanderthaloids." In their final report this opinion was modified and the idea of two distinctive types was abandoned. McCown and Keith (1939) still stressed that "the range in form . . . is unexpectedly great" in the series from the two sites. Nonetheless, they regarded these as "the remains of a single people, the Skhūl and Tabūn types being but the extremes of the same series, there being intermediates between these extremes." More recently McCown (1950) has reiterated the reasons for accepting this point of view.

The morphology which characterized the female skeleton (I) from the et-Tabūn cave was also present in some of the people of es-Skhūl. This is exemplified in Sk. VI (comprising a crushed part of the cranium and mandible and some parts of the post-cranial skeleton) and in Sk. VII (comprising much of the post-cranial skeleton, but a badly crushed cranium and mandible); and it was most evident in the bones of the extremities. The remains of other individuals, particularly the well-preserved skeletons of Sk. IV, V, and IX, exhibited in both cranial and postcranial morphology a majority of features which were anatomically modern in nearly all respects. In fact, as the writer has pointed out elsewhere (Howell, 1957; cf. Gieseler, 1955), the population of es-Skhūl exhibits all the necessary morphological attributes of an ancestral proto-Cro-Magnon people. This is true in spite of the presence within the population of a range of variation which overlapped that of early Neanderthal peoples. Moreover, the characteristic

morphological pattern of the people of es-Skhūl was not an isolated phenomenon in the Levant. It can be duplicated in all significant details among the skeletal remains from the cave of Djebel Qafzeh (Galilee). These were found with the same Mousterian of Levallois facies association and also date from the same late part of the Early Last Pluvial (Neuville, 1951). This series, comprising mostly skull and jaw fragments of five individuals, and which is still to be published, fully confirms the significance of the primitive, anatomically modern, morphology of the people of es-Skhūl.

It has been pointed out elsewhere (Howell, 1957) that there is no definite proof that the human remains from et-Tabūn (level C) and from es-Skhūl (level B) were contemporaneous and, therefore, representative of the *same* interbreeding population. Although both were of Early Last Pluvial age, geological and faunal evidence would suggest that the people from the es-Skhūl cemetery lived slightly later than did their counterparts of the et-Tabūn Levalloiso-Mousterian. However, the important problem is whether the range of variability was roughly the same in both series or had a different mean and merely overlapped in each instance. The suggestion is that the es-Skhūl population tended toward more anatomically modern morphology, although there was overlap with the et-Tabūn people at the other extreme of the range. If this is in fact the case, then there would appear to have been a trend in this region within the Early Last Pluvial toward increasing "sapiensization." The matter cannot yet be settled, since the et-Tabūn cave yielded too few human remains compared with the series from the es-Skhūl shelter (a total of ten individuals, some very incomplete, of both infants and adults, as well as sixteen other distinct isolated fragments), but must remain until larger skeletal series are available from this range of time in the southwest Asian area.

The rock shelter of Starosel'je, southern Crimea, has recently yielded infant human skeletal remains dating from the Early Last Glacial (Formosov, Gerasimov, and Roginskii, 1954; cf. also Ullrich, 1955; Vallois, 1956b). It was associated with a Mousterian industry like that at Kiik-Koba (upper level), predominantly made up of side-scrapers and some small hand-axes, with traces of an incipient blade-core technique. The skull can be quite well reconstructed, but the postcranial skeleton is so poorly preserved as to be useless. The Starosel'je individual may have suffered from hydrocephaly (although Prof. G. F. Debetz informs the author that this is doubtful), but nonetheless in the structure of the facial skeleton (as well as details of the vault) it resembled the morphological pattern of anatomically modern man. This discovery provides further evidence of quite anatomically modern people among the "Neanderthal" folk of southwest Asia and adjacent regions.

CONCLUSIONS

During the first quarter of this century some students of human paleontology, especially Schwalbe (1901a, b; 1906, 1923), Boule (1921), Adloff (1908), and Keith (1915), were inclined to exclude any "Neanderthal" peoples from the direct ancestry of anatomically modern man. In general four main arguments were advanced to support this conclusion: (1) a morphological hiatus of specific taxonomic significance existed between Neanderthal and anatomically modern peoples; (2) Neanderthal peoples were too specialized to be included among the forerunners of anatomically modern peoples; (3) time was too short to allow for the evolutionary transformation of Neanderthal man into an anatomically modern form (as represented by the first of the European Upper Paleolithic peoples); and (4) anatomically modern man, as *proven* by the fossil record, had a great Pleistocene antiquity (Keith, 1915, 1929) and this demonstrated the separateness of Neanderthal and anatomically modern human lineages over a long span of time.

The first two points are closely related. It is unquestionably true, as was shown by a number of the workers cited earlier, that *some* Neanderthal peoples were characterized by a very special pattern of skeletal morphology. However, these classic Neanderthals constituted only one of several groups of peoples of different geographic and temporal distribution which have been labelled Neanderthal. The unfortunate tendency to apply this designation to a multiplicity of Upper Pleistocene peoples (even at times to Middle Pleistocene peoples!), without proper appreciation for earlier definitions and understandings, has only resulted in confusion. Other human groups labeled Neanderthal, including both the early Neanderthals of the Last Interglacial and the Levant "Neanderthals" of the Early Last Pluvial, differed markedly in their morphology from the classic Neanderthals of southwestern Europe. In each case these differences were in the direction of anatomically modern human morphology.

The third point has constituted a stumbling-

block to paleoanthropologists for at least half a century. It is pertinent only so long as it refers to evolutionary transformation from classic Neanderthal peoples to succeeding Upper Paleolithic peoples *in the western European area*. The writer is not aware of any thoughtful worker in the field in the past half century who has specifically advocated this position. Yet the confusion does exist in general anthropological literature and, more importantly, it implies that any peoples labeled Neanderthal could only have represented an extinct segment of humanity. In a broader context, however, this point is not relevant. Only the fossil record can afford direct evidence which would give an indication of evolutionary rates and the time necessary for any such transformation. With our present lack of understanding of the genetic basis of nearly all morphological attributes, it is impossible to argue a priori that there was or was not sufficient time for such change to have occurred (*unless* it can be established that a very high degree of specialization was present). It is quite apparent that a great deal more must be known from the fossil record, both of temporal and spatial variation, before such arguments can have any real weight.

The final point is of particular importance, since some workers in the past and a number still at the present time attach to it a special relevance. Sir Arthur Keith was the most outspoken proponent of the point of view which advocated the great antiquity of anatomically modern man and he only abandoned it toward the end of his long and fruitful life (Keith, 1948). It is necessary to emphasize that it was always based on evidence which was either dubious or downright flimsy and equivocal. Students of the evolution of other mammalian groups have surely been more critical of their primary evidence than human paleontologists have been, in this instance. Critical reevaluations of the primary evidence or greatly improved or new methods of determining the relative age of fossil bones have conclusively shown in recent years that nearly every shred of evidence which was marshalled at one time or another to support this theory was either ill-appraised or fraudulent.

This theory of longstanding human polyphyletism was seriously undermined by these revelations, but it has not yet been completely abandoned. In recent years it has been modified and reframed by several workers, notably Vallois (1952, 1954) and Heberer (1949, 1950, 1951); Le Gros Clark (1954, 1955) has also supported the same general viewpoint, although phrased in a somewhat different taxonomic framework. One of the most elaborate and imaginative efforts to spell out the course of human evolution using such a theory as a point of departure has been made by Weckler (1954).

The fossil materials which now lend any support to this theory are indeed rare. Two incomplete human crania, one from a gravel pit at Swanscombe (Thames River) and another from the cave of Fontéchevade (Charente), furnish the only evidence for the so-called "pre-sapiens" lineage. The evidence itself is equivocal and ambiguous, as has been pointed out by several workers including Roginskii (1948), Sergi (1953a, b, c), Breitinger (1952, 1955), and the author (Howell, 1951, 1957). The parieto-occipital fragment from Swanscombe does not prove that an ancient anatomically modern human variety existed at the time of the Great Interglacial; it does confirm the presence in westernmost Europe of a human variety closely resembling that recovered from the gravels at Steinheim (a. d. Murr, Württemberg) which is of the same age. In his comparative study of the Swanscombe remains Morant (1938) pointed out that, "as far as can be seen, the Swanscombe and Steinheim skulls were quite similar, and it is not unlikely that they represent the same Acheulian group." Moreover, the recent discoveries of mandibles and teeth at Ternifine (Algeria) and Sidi Abderrahman (Morocco), as well as the earlier find of a mandible and maxilla at Rabat (Morrocco), clearly oppose such a theory. These skeletal remains buttress the Steinheim-Swanscombe materials as evidence of anatomically non-modern peoples having been responsible for the widespread Acheulian stone industry. This conclusion is further supported by the morphology of the mandible from Montmaurin (Haute-Garonne). It also, in the writer's opinion, tends to contradict the view that the fragmentary and distorted Fontéchevade remains were those of a primitive form of anatomically modern man (cf. Howell, 1957).

The Fontéchevade remains, probably two individuals represented respectively by a distorted and incomplete skullcap (no. 2) and a small fragment of frontal bone (no. 1), constitute the only evidence which might favor the theory that an incipiently anatomically modern group was present in the basal Upper Pleistocene (or terminal Middle Pleistocene, as the remains may be of Penultimate Glacial age). Since (at that time) nearly all parts of Europe were occupied by early Neanderthals

(or their forerunners), this would imply that several distinct forms of man were present in the same general area. To remain distinct, and such has been clearly implied in the designation "pre-sapiens," genetic interchange must have been prohibited or at an absolute minimum; otherwise such differences would have disappeared as a consequence of hybridization. If these groups were populations (demes) of the same species, with a common evolutionary origin, but an isolated development, presumably there would have been attendant fusion into a single variable population as they came together. Otherwise, these must have represented distinctive sympatric species which led dissimilar ways of life and were characterized by habit and behavioral differences, so much so that interbreeding did not customarily occur.

The writer is unable to find any paleoanthropological evidence which would favor this conclusion. Such an explanation might appear more likely if this was a case of a distinctive geographic area where a particular species had developed through isolation. The evidence of the fossil record indicates that (until the main interstadial of the Last Glacial) the area was extensively occupied by Neanderthal peoples. If such Neanderthal peoples, and their anatomically non-modern forerunners (Steinheim-Swanscombe, Montmaurin), were indigenous to the European area any "pre-sapiens" peoples must have had an origin elsewhere and have subsequently expanded into (western) Europe. Where was this area and where is the fossil and other evidence necessary to support such an hypothesis? Actually, the Fontéchevade human remains themselves are not fully conclusive as to whether these were "anatomically modern" or

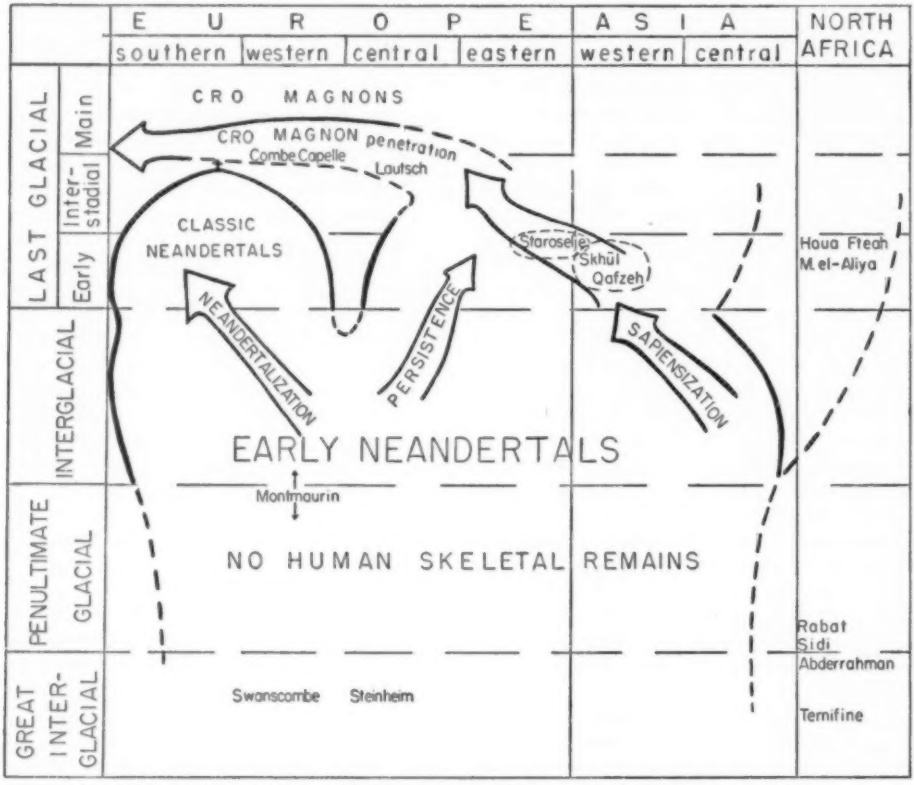

FIG. 4. TEMPORAL AND SPATIAL DISTRIBUTION OF "NEANDERTHAL" PEOPLES OF THE UPPER PLEISTOCENE AND OF THEIR MIDDLE PLEISTOCENE FORERUNNERS

represented a variety of early Neanderthal (Howell, 1957). In the light of this fact it would appear judicious to resist founding a far-reaching theory of modern human evolution on evidence which is at best inconclusive (cf. Washburn, 1954). One is reminded of Jepsen's (1944) admonition "that genealogical trees for fossils must be strong enough to support the opinions they are devised to symbolize and that large branches shouldn't be inferred too readily from small morphologic evidences."

With the steadily increasing breadth of the hominid fossil record human paleontologists must reexamine certain basic concepts in earlier studies of man's evolution. Older ideas of simple rectilinear development, whether uniphyletic or biphyletic, are no longer either useful or justifiable. These are in fact merely another version of the familiar family tree which, in its usual form, fails to take into consideration the distribution of human populations in space and time, their variability, and their biological and cultural adaptations to changing Pleistocene environments. Nor has sufficient attention been devoted to the problems of competition and territoriality in such early hunter-gatherers, both of which are of the utmost significance for any simple biphyletic account of the origins of the anatomically modern varieties of man.

Peoples who have been labeled "Neanderthal" are of particular importance in human evolutionary studies because of their temporal distribution and their spatial range (Fig. 4). The concept of a "Neanderthal" phase or stage of man's evolution is no longer useful since there was marked variability from one such group to another. Frequently, as in the case of certain human remains from southeast Asia (Solo man) and southern Africa (Broken Hill, Saldanha, Florisbad men), the application of the designation "Neanderthal" has obscured rather than clarified the real nature and importance of the human skeletal materials. In this paper an attempt has been made to outline some of the present understandings about Neanderthal peoples and to stress the need for their careful study and reevaluation if studies of man's evolution are to proceed along potentially fruitful directions.

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III. PATHOLOGY AND THE POSTURE OF NEANDERTHAL MAN

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INTRODUCTION

NEANDERTHAL man is commonly pictured as but incompletely erect; as an almost hunchbacked creature with head thrust forward, knees habitually bent, and flat, inverted feet, moving along with a shuffling, uncertain gait. According to this view, he was a thoroughly unattractive fellow who was but imperfectly adapted to the upright, bipedal posture and locomotion characteristic of the modern type of man. This notion of Neanderthal man—and we herein use the term "Neanderthal" in its more restricted and proper sense, i.e., as referring to so-called classic Neanderthal man of the Würm or fourth glacial period—undoubtedly goes back to the discovery of the holotype Neanderthal specimen near Düsseldorf, Germany, just 100 years ago, in 1856. It received impetus from the subsequent discovery of the Spy skeletons (1886) and was finally crystallized by Marcellin Boule's (1911–13) detailed analysis and reconstruction of the skeleton of the man of La Chapelle-aux-Saints found in 1908.

The La Chapelle-aux-Saints skeleton has constituted the type specimen for the assessment of Neanderthal posture; for it is the only Neanderthal skeleton possessing any significant quantity of vertebrae, and vertebrae must needs provide a decisive factor in any attempt at reconstruction of body-posture. Boule (1923), in his book on fossil men, gives a succinct account of his interpretation of Neanderthal man's posture:

> . . . the differences between the skeleton of Neanderthal Man and that of modern Man are such that they necessarily imply certain differences in the general bearing and attitude of the body. The great development of the face, the backward position of the *foramen magnum* which must have caused the body to incline forward, the slighter curve of the cervical and lumbar regions of the vertebral column, and the distinctly simian arrangement of the spinous processes of the cervical vertebrae, all testify to this fact. With regard to the lower limb, it is clear that if the formation of the pelvis and the great development of the gluteal muscles indicate that a biped attitude had already been attained, the anatomical characters of femur and tibia, seen in profile in the upright position, show that the leg and thigh, when extended, could not have been in a precisely straight line with each other; that the femur must have sloped downwards and forwards, and that the tibia, sloping in a contrary direction, must have formed a wide angle with the femur. So that, without being mechanically impossible, the total extension of the knee could not have been normal, and the habitual attitude must have been one of semi-flexion. The fibula, stronger in character, had a most important part to play as a support. The general appearance of the articulations of the foot indicates a greater degree of mobility and freedom. The foot, still only slightly arched, must have rested on the ground on its outer edge, and must have assumed naturally an in-toed position; the wide separation of the great toe shows that it may have played the part of a prehensile organ. In general, the ordinary, normal carriage of Neanderthal Man must then have differed in some degree from our own.

Boule's reconstruction of the La Chapelle-aux-Saints skeleton, with the trunk inclined forward, is shown in Fig. 1, wherein it is contrasted with that of an aboriginal Australian. The contrast is so obvious as to need no elaboration here. This reconstruction has come to be generally, if uncritically, accepted. Over the years it has assumed an almost canonical flavor and has greatly influenced subsequent writers.

Thus, Osborn (1918) pictured Neanderthal man as stooping, with the upper part of his body thrown forward, head and neck "habitually bent forward into the same curvature as the back,"

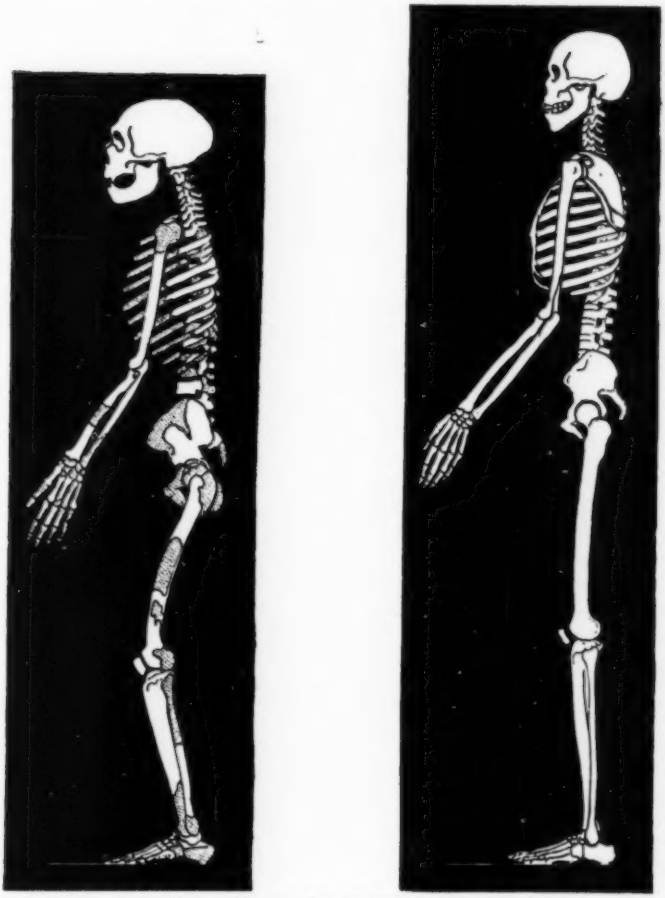

FIG. 1. SKELETONS OF THE FOSSIL MAN OF LA CHAPELLE-AUX-SAINTS, RECONSTRUCTED (LEFT), AND AN ABORIGINAL AUSTRALIAN (RIGHT)

After Boule (1923).

and "knees habitually bent forward without the power of straightening the joint or of standing fully erect." His hands lacked "the delicate play between the thumb and fingers characteristic of modern races."

Elliot Smith (1924) displayed an eloquent enthusiasm in describing "uncouth and repellent Neanderthal Man," with body not "truly erect," for which the La Chapelle-aux-Saints skeleton afforded a "clear-cut picture." Thus, wrote Elliot Smith,

> His short, thick-set, and coarsely built body was carried in a half-stooping slouch upon short, powerful, and half-flexed legs of peculiarly ungraceful form. His thick neck sloped forward from the broad shoulders to support the massive flattened head, which protruded forward, so as to form an unbroken curve of neck and back, in place of the alternation of curves which is one of the graces of the truly erect *Homo sapiens*. The heavy overhanging eyebrow-ridges and retreating forehead, the great coarse face with its large eye-sockets, broad nose, and receding chin, combined to complete the picture of unattractiveness, which it is more probable than not was still further emphasized by a shaggy covering of hair over most of the body. The arms were relatively short, and the exceptionally large hands lacked the delicacy and nicely balanced co-operation of thumb and fingers

which is regarded as one of the most distinctive of human characteristics.

Writing 20 years later, Howells (1944) was more objective; but he still accepted the Bouleian picture. Thus, Howell's Neanderthal man both stood and walked with rounded back, bent knees, and flattened, inverted foot, and so was less erect than modern man. More recently, Young (1952) has categorically stated that "there is no doubt that Neanderthal man did not walk fully upright," and Coon (1954) has emphasized that "alone of all fossil men so far found, Neanderthal failed to stand completely erect." Additional similar examples from the literature could be given; but those already cited suffice to demonstrate that Boule's reconstruction of the posture of Neanderthal man has persisted to the present day.

Certain authors, nevertheless, have displayed less than a complete confidence in the Bouleian picture of a semi-erect Neanderthalian. Thus, over three decades ago, Schwalbe (1923) contented himself with the conclusion that the structure of femur and tibia indicates that Neanderthal man had an awkward albeit upright gait, with slight knee-flexion and thigh-abduction. Sollas (1924) merely noted that his skeleton exhibits some characters "which suggest that Neanderthal man maintained less habitually a completely erect attitude." Keith (1925), although taking note of Boule's reconstruction, apparently did not accept it fully; for he stated that "all parts of his body are as perfectly adapted to the upright posture as are those of modern man." It is clear that Hooton (1946) also had some doubts. Although he accepted Boule's appraisal of Neanderthal spinal and pedal morphology, and admitted that "the gait may have been a shuffling, bent-knee walk, in which the legs were not completely extended upon the thighs," he noted, on the other hand, that the linea aspera of the femur "is sufficiently marked to indicate an upright carriage," and that the "foot could probably be fitted in a modern shoe shop." Le Gros Clark appears no less undecided than was Hooton; for, after emphasizing that a "limb skeleton adapted for a fully erect posture and gait" is diagnostic of the genus *Homo* (1955), he continues to note that *Homo neanderthalensis* "evidently walked in rather a stooping posture and with a lumbering gait" (1956).

In recent years, however, some students have begun to entertain really serious doubts concerning the validity of the generally accepted concept of Neanderthal posture which stems from Boule's reconstruction of the so-called "Old Man" of La Chapelle-aux-Saints. Thus, Schultz (1942) concluded that the original Gibraltar skull (the first discovered Neanderthal skull, in 1848) must have been balanced on the vertebral column quite as in many modern men. In a later paper, Schultz (1955) definitely rejected the orthodox concept of Neanderthal posture and progression, stating that he "could never understand how any creature can be 'nearly upright' in the manner in which Neanderthal man has sometimes been reconstructed with his trunk leaning forward and taking a long step in order to prevent his falling. Such a posture, in which the center of gravity lies well in front of the center of support, is never maintained by any child learning to walk nor by any ape standing on its hind legs. Even in the beginning stages of upright posture the trunk must have already been held *fully* erect, to be most easily balanced, but this bipedal posture changed only gradually from an occasional attempt to a constant habit." In the same year, Arambourg (1955) came independently to essentially the same conclusion. Like Schultz, he believed that permanent bipedal erectness cannot be other than total. He concluded, therefore, that, contrary to earlier belief, the alignment of the trunk of Neanderthal man, both in habitual posture and in bipedal walking, did not differ appreciably from that of present-day man.

THE "OLD MAN" OF LA CHAPELLE-AUX-SAINTS

During July of 1955 the authors attended the Sixth International Anatomical Congress in Paris. A few months earlier, while in Washington, one of us (W.L.S. Jr.) was discussing the problem of Neanderthal man's posture, and particularly Boule's interpretation of the vertebral evidence, with Dr. T. D. Stewart. Largely because of some of Dr. Stewart's catalytic comments, this author was impelled to examine the La Chapelle-aux-Saints skeleton while in Paris. He gratefully acknowledges, therefore, Dr. Stewart's stimulating influence in this connection.

On July 26, 1955, we visited the Musée de l'Homme in Paris. The prime purpose of our visit was, admittedly, an examination of the controversial Fontéchevade skulls. As it turned out, we had access only to casts of these skulls,

FIG. 2. SKULL OF MAN OF LA CHAPELLE-AUX-SAINTS

Seen from the side (above), from in front (lower left), and from above (lower right). After Boule (1911).

and we were not allowed to take any measurements. Hence, we soon turned our attention to the skeleton of La Chapelle-aux-Saints and to other original Neanderthal specimens which were housed in the Museum, which were made available to us for study through the kindness of Mlle. L'Estrange. At that time we were entirely unaware of Arambourg's (1955) study, which came to our attention some months later. Familiar only with the published descriptions and illustra-

tions of the La Chapelle remains and with casts of the skull, we were somewhat unprepared for the fragmentary nature of the skeleton itself and for the consequent extent of restoration required. Nor were we prepared for the severity of the osteoarthritis deformans affecting the vertebral column. It soon became clear why, in his reconstruction of the La Chapelle individual, Boule (1911–13, 1923) had found it necessary to turn to the Spy, La Ferrassie, and other Neanderthal skeletons for aid.

The accepted Bouleian reconstruction of Neanderthal body-posture was based upon an interpretation of the anatomy of skull, spine, pelvis, and lower limb. We therefore gave particular attention to these parts of the skeleton.

It is possible that the La Chapelle-aux-Saints skeleton may not, as commonly believed, be that of an "old man." Its precise age is not easily determined, however, the notoriously unreliable evidence of the cranial sutures being the principal criterion. Boule (1911–13) estimated its age at death as 50–55 years, Keith (1925) as possibly under 40 years, and Vallois (1937) as probably not more than 40 years. Our tentative estimate of age is 40–50 years, the upper limit remaining very uncertain.

As is well known, the nuchal plane of the La Chapelle skull is tilted somewhat upward (Fig. 2), and the curiously elongate foramen magnum and the occipital condyles are situated somewhat more dorsally on the cranial base than they are in modern man—an arrangement which has been an important factor in ascribing a forward tilt to the head of Neanderthal man. Arambourg (1955), however, believes that the base of the La Chapelle skull has undergone deformation in the course of its reconstruction, which, in part at least, accounts for the rather simian position of the foramen magnum. We are disposed to agree to the extent that the cranium has undergone some degree of post mortem deformation and that its reconstruction may not be perfect; but when Arambourg invokes the Saccopastore I, Skhūl V, Solo, and Rhodesian skulls to brand the La Chapelle skull base as anomalous, at best, for Neanderthal man, we are unable to agree with him. For it is questionable whether any of these particular specimens should actually be regarded as genuine Neanderthalians; whatever precisely they may be, they are not Neanderthal *sensu stricto* and therefore cannot be used in determination of the head-posture of classic Neanderthal man of the Würm glaciation.

VERTEBRAL COLUMN

The spine of La Chapelle-aux-Saints is represented by 5 cervical, 11 thoracic, and 4 lumbar vertebrae, most being very imperfect, and a fragment of the sacrum bearing part of the auricular surface (Fig. 3). Boule (1911–13) merely noted that many of these vertebrae exhibit arthritic processes along the margins of their bodies. Vallois (1949), however, stated that the last three cervicals, the first three thoracics, and all of the lumbars were pathologically affected, their bodies being "en diabolo." Yet, Boule's mere passing reference to the spondylitis and the absence of any indication that he regarded it as a factor of any importance in his reconstruction of the spine left us wholly unprepared for the severity and extent of the osteoarthritis deformans in the La Chapelle skeleton.

The atlas, which is incomplete, has been improperly reconstructed, so that its articulation with the equally incomplete axis is unsatisfactory. The restored anterior atlantal arch seems much too small, in consequence of which the articulation of one atlantal lateral mass with the appropriate superior axial articular process leaves an enormous and unnatural gap contralaterally between the corresponding portions of the two vertebrae. A much broken and decayed odontoid process is abnormally deflected from the median plane. The articular surfaces of both the left and right atlanto-axial joints exhibit a considerable degree of osteoarthritic change. The bodies of the remaining (fifth, sixth, seventh) cervical vertebrae, the corresponding zygapophyses, and the postzygapophyses of the first thoracic vertebra are all grossly affected by a deforming osteoarthritis. The remaining thoracic and the lumbar vertebrae are so defective that considerable restoration has been necessary; their original portions, however, exhibit evidence of a rather generalized osteoarthritis.

Boule noted that the La Chapelle vertebral bodies were shorter in cranio-caudal dimension than corresponding modern vertebrae, and argued in consequence for a relatively short trunk stature in Neanderthal man. The precise extent to which the La Chapelle vertebrae are reduced in height as a result of both pathological and age change seems not to have received serious consideration

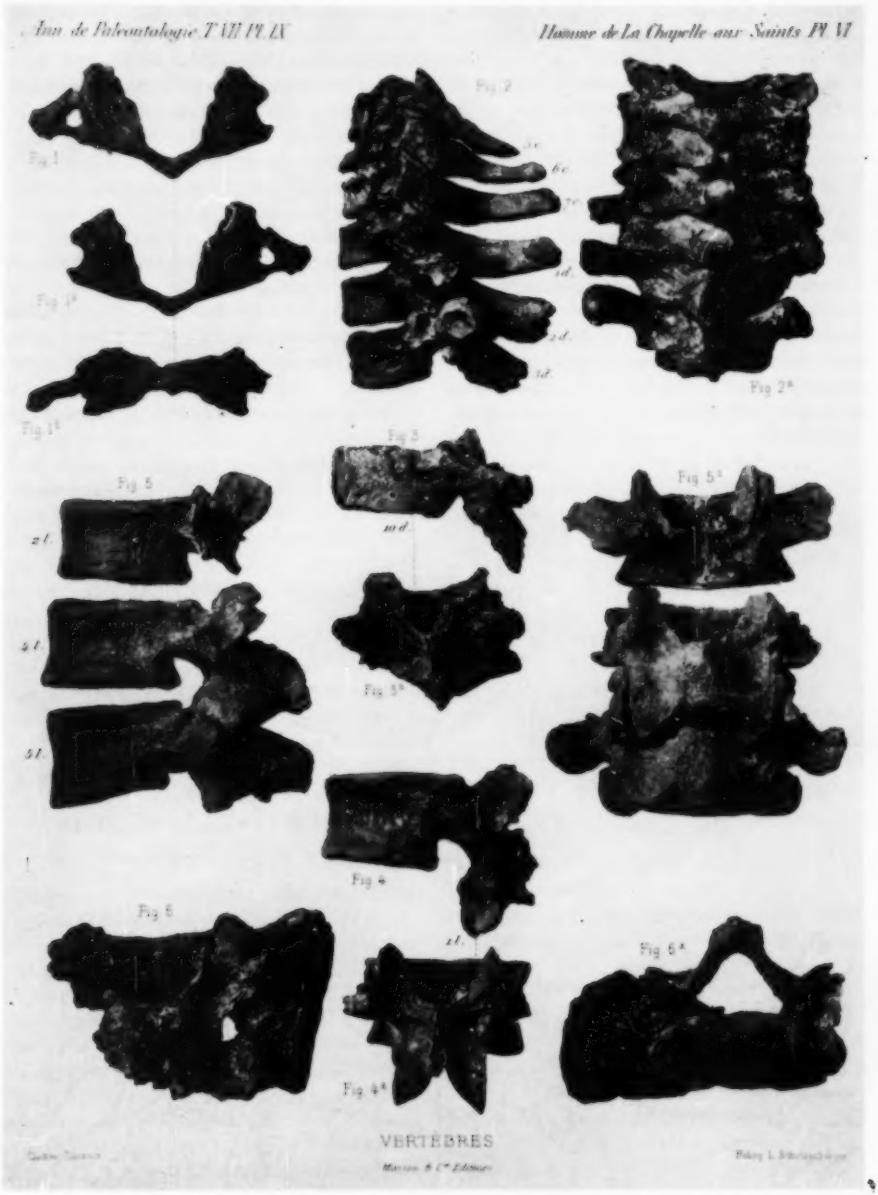

FIG. 3. VERTEBRAE OF THE MAN OF LA CHAPELLE-AUX-SAINTS

Atlas (1, 1a, 1b); fifth, sixth, and seventh cervical and first, second, and third thoracic vertebrae (2, lateral view; 2a, posterior view); tenth thoracic vertebra (3, lateral view; 3a, posterior view); first lumbar vertebrae (4, lateral view; 4a, posterior view); second, fourth, and fifth lumbar vertebrae (5, lateral view; 5a, posterior view); sacrum (6, superior view; 6a, posterior view). After Boule (1912).

hitherto. Yet that such change has occurred is obvious, and a similar change undoubtedly involved at least some of the (lacking) intervertebral disks. The La Chapelle spine therefore does not constitute the most favorable material for an attempted assessment of healthy, normal Neanderthal posture.

In his reconstruction, Boule has pictured the cervical spine as without the lordosis characteristic of modern man, and as flattened (if not actually concave) anteriorly. He likewise assumed the lumbar lordosis to be less than in modern men. Hence the unnaturally straight spine which gives his reconstructed man of La Chapelle an equally unnatural forward tilt and stooping, "top-heavy" posture (see Fig. 1). Some appreciation of spinal osteoarthritis in its several manifestations, and clinical familiarity with its postural consequence, would have prevented so faulty a reconstruction. The fifth, sixth, and seventh cervical vertebrae are crucial to the validity of Boule's argument for his reconstruction of the La Chapelle neck. He noted, correctly, that the spinous processes of these vertebrae are long and but little retroverted (i.e., the long axis of the process forms little or no angle with the ventrodorsal axis of the corresponding vertebral body), an arrangement that contrasts markedly with that occurring in present-day man, whose cervical spinous processes are usually shorter and strongly retroverted. In this "distinctly simian arrangement of the spinous processes of the cervical vertebrae" Boule regarded the La Chapelle skeleton as resembling the anthropoid apes,

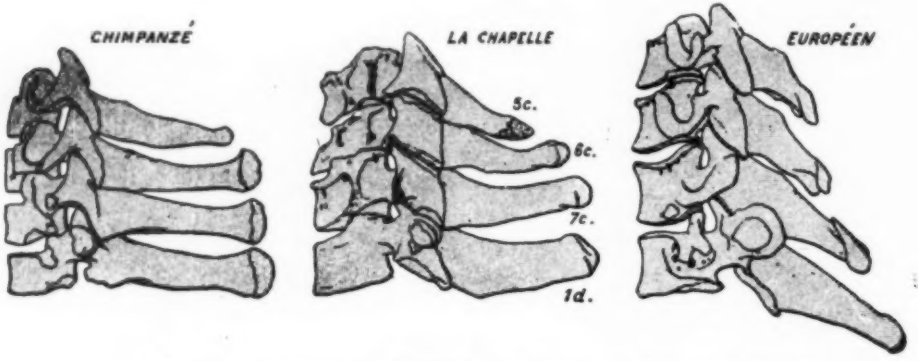

FIG. 4. COMPARISONS OF THE LAST THREE CERVICAL AND FIRST THORACIC VERTEBRAE

A chimpanzee (left); the man of La Chapelle-aux-Saints (center); and a modern European (right). After Boule (1912).

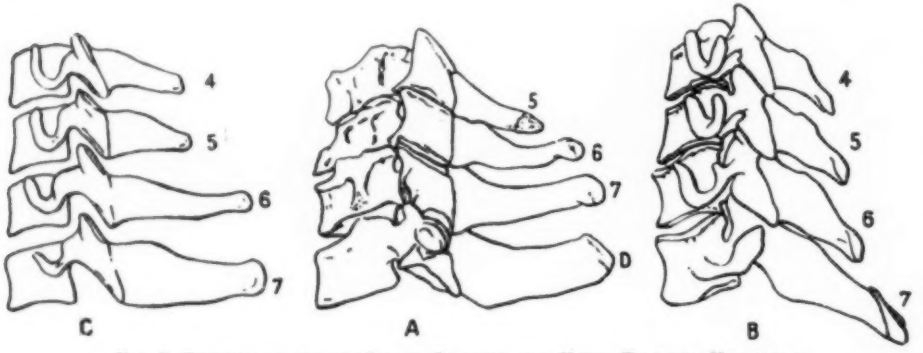

FIG. 5. COMPARISONS OF THE LOWER CERVICAL AND UPPER THORACIC VERTEBRAE

Left, of a modern European (from a radiograph); center, of the man of La Chapelle-aux-Saints (from Boule, 1912); right, of a modern European (from Boule, 1912). After Arambourg (1955).

particularly the chimpanzee (Figs. 3, 4). To this greater length and lack of retroversion of the cervical spinous processes Boule added the tendency towards non-bifidity of their free extremities. On the basis of these characters, plus a diminished obliquity of the cervical zygapophyses, he postulated a reduction or even an absence of the cervical lordosis and included in his skeletal reconstruction a straight cervical spine which gave the La Chapelle head a curious forward thrust.

The La Chapelle cervical spinous processes are certainly longer than their counterparts in modern races of men. In general, such relatively greater length may well be the morphological expression of a relatively less mobile cervical column. Unfortunately, even in modern human racial material, in which spinous-process length varies considerably, there exists as yet no satisfactory method of correlating such length with degree of cervical mobility. The problem therefore awaits further investigation. Long as they are, however, the La Chapelle cervical spinous processes seem to us to be relatively shorter (compared with their vertebral bodies) than in the anthropoid apes. Certainly, moreover, their three-dimensional morphology is very unapelike; they are essentially prismatic or bayonet-shaped, triangular in cross-section, rather than flattened laterally and oar-like as in the apes. This feature, readily noticeable in the actual skeleton, necessarily cannot be seen in drawings or tracings of the bones in norma lateralis.

The supposed significance of the non-retroversion of the La Chapelle cervical spinous processes disappears in the light of Arambourg's (1955) radiographical findings that elongated, non-retroverted cervical spinous processes occur frequently in modern Europeans with perfectly normal vertebral posture (Fig. 5).

Bifidity (terminal bifurcation) of cervical spinous processes is a notoriously variable feature of modern vertebral material and, as Le Double (1912) has shown, is devoid of deep significance. In the La Chapelle skeleton the seventh cervical spinous process is typically non-bifid, as in all such hominoid vertebrae, whether human or anthropoid-ape. The sixth cervical spinous process is slightly bifid apically. The tip of the fifth cervical spinous process is lacking, so that its exact condition during life cannot now be determined. Boule obviously regarded the La Chapelle cervical vertebrae as having at least a tendency towards apical non-bifidity and considered non-bifidity itself to represent a simian character; for, in the anthropoid apes, the lower cervical spinous processes usually are non-bifid or, at best, but feebly so. In fact, however, even though all the La Chapelle cervical vertebrae had possessed non-bifid spinous processes, such non-bifidity would by no means have constituted a non-human character, since such a condition is not infrequently encountered in present-day human skeletons.

TABLE 1

Percentage incidence of non-bifidity of cervical spinous processes in some groups of modern men

Racial Group	Number of Columns	C. 2	C. 3	C. 4	C. 5	C. 6	C. 7
Andamanese	15	?	73.3	73.3	53.3	73.3	100.0
Australians	15	?	73.3	66.7	66.7	80.0	100.0
Ancient Egyptians	40	10.0	47.5	15.0	10.0	42.5	100.0
Europeans	85	15.3	43.5	16.5	16.5	48.2	100.0

The seventh cervical spinous process is invariably non-bifid in all human spines, of whatever racial group or historic period. The sixth cervical spinous process is remarkably often non-bifid in modern Europeans and is generally so in certain non-European peoples (Le Double, 1912; Terry, 1925). Indeed, all of the infra-axial cervical spinous processes may be non-bifid, as recorded by Le Double (1912) and as observed by one of us (A.J.E.C.). Shore (1931) has shown that, in the cervical vertebrae of both Bushman and Bantu, non-bifidity is the rule and bifidity the exception. Moreover, the accompanying Table 1, summarizing a particular investigation of non-bifidity by one of us (A.J.E.C.; see Cave, 1932), reveals this feature to be of much greater frequency than commonly supposed. From these data it is apparent that non-bifidity of cervical spinous processes cannot be interpreted as a "simian" character and that neither bifidity nor non-bifidity affords any diagnostic guide to cervical curvature or to posture of the living neck.

Finally, in considering the neck, there is the matter of the reduced obliquity of the cervical articular processes (zygapophyses) recorded by Boule. But these facets, like their lumbar homologues, exhibit a wide range of variability in both shape and slope in modern men. Although cor-

related in some degree, perhaps, with body-habitus, it is exceedingly doubtful whether they provide dependable evidence for determination of the precise alignment and carriage of the living neck. Moreover, the La Chapelle facets themselves have been affected by a destructive osteoarthritis and, in consequence, have undergone at least some pathological modification.

Boule seems to have paid scant attention to the role of the intervertebral disks in determining the shapes of the several regions of the vertebral column. Yet it is possible—indeed likely—that the pathological change in the La Chapelle cervical segment was initiated by a shrinkage and diminution of its disks; and it is a commonplace of clinical experience that cervical disk-shrinkage profoundly alters the normal lordosis of the cervical spine.

In view of the foregoing considerations and of the pathological state of the La Chapelle cervical region—which makes any reconstruction largely conjectural—we readily concur with Arambourg that there exists no valid reason for Boule's assumption that the man of La Chapelle-aux-Saints differed fundamentally from modern man in his cervical curvature and the carriage of his head. This conclusion is further supported by the variability of head posture among modern groups of men, as well as by Schultz's (1942) conclusions regarding cranio-vertebral relationships in another classic Neanderthal specimen, the Gibraltar I skull.

We are similarly unconvinced by Boule's assumption that the lumbar curvature (lordosis) in the La Chapelle man was less pronounced than in the majority of modern men. The fragmentary character of his lumbar vertebrae—especially of their bodies—, the local osteoarthritis and, above all, ignorance of the inevitably absent intervertebral disks (which have a most important role in determining the shape of the lumbar region), make any truly accurate reconstruction of this portion of the vertebral column impracticable. From our own examination of the La Chapelle spine, we remain unconvinced that, in structure and configuration, the lumbar region lay outside the normal range of variability found in modern man.

PELVIS

The La Chapelle sacral and coxal fragments are morphologically indecisive; they can be readily matched in the pelves of present-day men. There is nothing that is non-human or simian about them. This conclusion is confirmed by the evidence of the more complete os coxae of the Neanderthal specimen from Düsseldorf. An unpublished comparative study of a cast of the latter bone by one of us (W.L.S. Jr.) shows that it is distinctively human in its assemblage of characters and in no sense morphologically intermediate between modern man and other primates (including the anthropoid apes). All of its features fall within the range of variation found in modern man. The ischial tuberosity is quite large (as it also is in the La Chapelle-aux-Saints skeleton), being very broad but not remarkably elongated. Yet, in its general configuration and location it is quite human and not at all like the tuberosities of the anthropoid apes. Klaatsch (1901) thought that both parts of the Düsseldorf sacral surface—iliac tuberosity and auricular (articular) surface—differ from those of modern men, but there is no valid reason for such a conclusion. The iliac tuberosity, although incomplete, was obviously large, both absolutely and relatively, as in living men; whereas in the anthropoid apes it is notably small (Straus, 1929; Schultz, 1930). The auricular surface is definitely human in size and form and falls well within the modern human range of variation, which is very great in respect of exact configuration. Contrariwise, it differs from the auricular surfaces of the anthropoid apes (see Straus, 1929). Other characters of the Düsseldorf bone, such as a deep greater sciatic notch and a prominent anterior inferior iliac spine, are peculiarly human and exceedingly unapelike. The iliac tubercle and pillar, structures which are believed to be related to the balance of the body in the fully erect, bipedal posture (Mednick, 1955), are well-developed in the Düsseldorf hip-bone. Moreover, Weidenreich (1913) has stated that the angle between ilium and ischium in the Neanderthal hip-bone is indicative of an erect posture. Thus Boule's attribution of "vestiges of simian structure" (1923) and of approach to the anthropoid apes (1911–13) to the pelvis of Neanderthal man is without basis of anatomical fact. Indeed, if the hip-bones of the Australopithecinae can be regarded—as is the current orthodox view—as indexes of an erect, bipedal posture (whether perfect or imperfect), it is impossible to regard the hip-bones of the Düsseldorf and La Chapelle-aux-Saints skeletons

as indicative of anything other than a fully erect posture, in no wise different from that of present-day men.

LIMB BONES

The morphology of the bones of the free part of the lower extremity of the skeletons of La Chapelle man and other Neanderthalians has been employed as an argument that Neanderthal man walked with knees habitually bent and upon the outer margins, rather than upon the soles, of his feet. This assumed Neanderthalian habitual genuflexion derives in part from the considerable normal curvature of the femoral shafts and, especially, from the pronounced retroversion of the heads of the tibiae (see Fig. 1). Each of these characters, however, exhibits a very marked degree of individual variability in modern man, as Manouvrier (1893) and others have shown. Indeed, the degree of retroversion present in the Neanderthal tibiae from Spy, La Chapelle-aux-Saints, and La Ferrassie is no greater than that found in many present-day men (see Manouvrier; also Straus, 1927). Marked tibial retroversion is associated with individuals whose habits of life involve frequent bending of the knee, such as mountaineers. It is also found in groups, such as the Panjabi, who consistently adopt the squatting posture (Charles, 1894). Indeed, it seems not unlikely that Neanderthal man was a habitual "squatter." Such a habit would account not only for his considerable tibial retroversion but also for the supernumerary articular facets present on the lower ends of the La Chapelle and La Ferrassie tibiae and upon the corresponding tali. These facets occur in high frequency among modern populations of "squatters," as noted by Charles (1894) and others. Such considerations regarding squatting do not in any way predicate, of course, that Neanderthal man was incapable of extending his knee when standing or when walking on a flat surface. In respect of the significance of Neanderthalian femoral curvature and tibial retroversion, Arambourg (1955) has arrived at a similar conclusion.

Torsion of the tibia apparently varied greatly in Neanderthal man, as it does in modern man (see Straus, 1927). It is significant, however, that the Neanderthalians possessed a "positive" torsion as in modern man, rather than a "negative" torsion as do anthropoid apes (see Boule, 1911–13). His toes must therefore have pointed outward as in modern man, and not inward as in the apes. Boule (1923) therefore erred in assuming a natural "in-toed" position for the foot of Neanderthal man.

The supposed simian characters of the Neanderthal foot, said to indicate its imperfect adaptation for an erect, bipedal posture, have been greatly exaggerated by Boule and others. Indeed, in many details the foot of Neanderthal man can be regarded as "ultrahuman." Weidenreich (1921), in particular, has shown that Boule's reconstruction, which led him to the conclusion that Neanderthal man rested his weight wholly upon the outer border of the foot, is open to serious criticism. Even Morton (1926), who regarded the Neanderthal foot as in some respects intermediate between that of gorilla and that of modern man, did not challenge its fitness for a truly erect posture.

The hand of Neanderthal man merits some attention in view of what Osborn (1918) and Elliot Smith (1924) have said about its assumed incapacity for performing delicate movements, particularly those involving the cooperation of the thumb and other digits. It must first be stated that there is nothing in the morphology of the Neanderthal hand skeleton to support this conjecture. Boule (1923) himself regarded it as "very human in character." The relative proportions of the fingers in the La Chapelle and La Ferrassie skeletons (considering metacarpals as well as phalanges) fall within the ranges of modern human variation and differ markedly from those found in the great apes (Sarasin, 1931). The thumb is not unusually short, as sometimes stated, nor is there any reason to suppose that its power of opposability was less than in present-day men. Boule thought the La Chapelle os capitatum to be remarkably small, and we are able to confirm that impression. Yet, according to the data of Sarasin (1931), when the length of the Neanderthal capitate is compared with that of the third metacarpal, it is found to be quite as large or even larger, relatively, than the capitates of many modern human racial groups. Aside from the concrete evidence provided by his manual skeleton, one cannot ignore the evidence furnished by the worked implements that constitute the Mousterian lithic culture associated with classic Neanderthal man. It is well-nigh impossible to conceive that these could have been

manufactured by individuals deficient in manual dexterity.

Elliot Smith (1924) seems to have derived his poor opinion of Neanderthal man's manual skill from a study of his endocranial casts. For he states: "Many recent writers have been puzzled to account for the great size of his brain, seeing that the average capacity of the Neanderthal cranium exceeds that of modern Europeans. But . . . the development of the brain of Neanderthal Man was partial and unequal. That part of the organ which plays the outstanding part in determining mental superiority was not only relatively, but actually, much smaller than it is in *Homo sapiens*. The large size of the Neanderthal brain was due to a great development of that region which was probably concerned primarily with the mere recording of the fruits of experience, *rather than with the acquisition of great skill in the use of the hand and the attainment of the sort of knowledge that comes from manual experiment*" (p. 70; italics ours) . . . "However large the brain may be in *Homo neanderthalensis*, his small prefrontal region is sufficient evidence of his lowly state of intelligence and reason for his failure in the competition with the rest of mankind" (p. 41). Despite Elliot Smith's eminence as an authority on primate cerebral morphology, we are unable to share his assurance in the interpretation of Neanderthal endocranial casts, or, indeed, of endocranial casts in general. Moreover, it must be recalled that it was Elliot Smith (1913, 1924) who found distinct evidences of primitive characters in the endocranial cast of the notorious Piltdown cranium—a cranium that later proved to be not only human, but of recent origin as well.

In some ways, Elliot Smith's appraisal of Neanderthal mentality is but a modified echo of Boule's earlier estimate derived from endocranial casts and archeological evidence. For Boule (1923), after studying Neanderthalian endocranial casts—in particular that of the La Chapelle-aux-Saints skull—stated that in "the simplicity and coarse appearance of the convolutions . . . the brain of Neanderthal Man more resembles the brains of the great anthropoid apes or of microcephalic man." He also noted that, in respect of "the relative development of his frontal lobe, which is debased and slants backwards," Neanderthal man "may thus be ranked between the anthropoid apes and modern Man, and even nearer to the former than to the latter." He thought, moreover, that both the occipital lobes and the cerebellum, "in the sum of their characters, greatly resemble those of the anthropoid apes." In summary, Boule stated: "It is probable, therefore, that Neanderthal Man must have possessed only a rudimentary psychic nature, superior certainly to that of the anthropoid apes, but markedly inferior to that of any modern race whatever. He had doubtless only the most rudimentary articulate language. On the whole, the brain of this fossil Man is already a human brain because of the amount of its cerebral matter; but this matter does not yet show the superior organization which characterizes Modern Men" (1923, pp. 232–236). Continuing, Boule stated: "It is important to note that the physical characters of the Neanderthal type are quite in agreement with what archaeology teaches us as to his bodily capacity, his psychology, and his habits. As we have already pointed out, there is hardly a more rudimentary or degraded form of industry than that of our Moustierian Man. His use of one simple material only, stone (apart probably from wood and bone), the uniformity, simplicity, and rudeness of his stone implements, and the probable absence of all traces of any pre-occupation of an aesthetic or of a moral kind, are quite in agreement with the brutish appearance of this energetic and clumsy body, of the heavy-jawed skull, which itself still declares the predominance of functions of a purely vegetative or bestial kind over the functions of the mind" (1923, pp. 237–238; also see 1913, p. 227). "What contrast with the men of the next geological and archeological period, with the men of the Cro-Magnon type, who had a more elegant body, a finer head, an upright and spacious brow, and who have left, in the caves which they inhabited, so much evidence of their manual skill, artistic and religious preoccupations, of their abstract faculties, and who were the first to merit the glorious title of *Homo sapiens!*" (Boule, 1913, p. 227; free translation). It is unnecessary to detail the respective roles of fact, fancy and, perhaps, even emotion, in Boule's estimate. Moreover, other competent students of fossil man have arrived at a far more favorable appraisal of Neanderthal man's intellectual and psychic capacities, as well as of his manual dexterity, after studying the anatomical and cultural evidence.

CONCLUSIONS RESPECTING THE POSTURE OF NEANDERTHAL MAN

There is thus no valid reason for the assumption that the posture of Neanderthal man of the fourth glacial period differed significantly from that of present-day men. This is not to deny that his limbs, as well as his skull, exhibit distinctive features—features which collectively distinguish him from all groups of modern men. In other words, his "total morphological pattern", in the phraseology of Le Gros Clark (1955), differs from that of "sapiens" man. Yet there is nothing in this total morphological pattern to justify the common assumption that Neanderthal man was other than a fully erect biped when standing and walking. It may well be that the arthritic "old man" of La Chapelle-aux-Saints, the postural prototype of Neanderthal man, did actually stand and walk with something of a pathological

kyphosis; but, if so, he has his counterparts in modern men similarly afflicted with spinal osteoarthritis. He cannot, in view of his manifest pathology, be used to provide us with a reliable picture of a healthy, normal Neanderthalian. Notwithstanding, if he could be reincarnated and placed in a New York subway—provided that he were bathed, shaved, and dressed in modern clothing—it is doubtful whether he would attract any more attention than some of its other denizens.

One should not criticize Boule too harshly for his misleading picture of Neanderthal posture. His study must be placed in its proper historical setting. Boule recognized (1913, 1923) that Neanderthal man was no direct, lineal ancestor of modern man, but, rather, the end-product of an evolutionary line collateral to, but independent of, that leading to the modern type of man. For he felt certain that "men of relatively higher organization, direct forebears of various forms of *Homo sapiens*, existed from very early times in Europe simultaneously with the Neanderthal type," which therefore "could not be the ancestor of *Homo sapiens*, since representatives of both species were contemporary." Boule was impressed, however, by the "archaic characteristics" of Neanderthal man, expressed by "the numerous simian traits" which he "retained as so many relics, still strongly in evidence, of an ancestral state." Thus he believed that this fossil type "represents a degree in the human scale lower, morphologically speaking, than all the stages of modern humanity," and that "the long series of primitive or simian traits which are imprinted on each constituent part of the skeleton, can only be interpreted as the marks of a more backward evolutionary stage than that reached by modern Mankind....." And to give such "simian" morphological characters their appropriate functional expression in skeletal reconstruction was but the logical consequence of this belief. Thus, although an evolutionary side-product, Neanderthal man represented a sort of skeleton in the phylogenetic cupboard, a lingering archaic stage in the evolution of the modern type of man.

Moreover, in the earlier years of this century the concept of a *definite* Neanderthal "phase" or "stage" in the evolution of "sapiens" man was still pretty widely and firmly maintained (despite its rejection by a number of competent students of human evolution). Vigorously expounded by Hrdlička (1927, 1930), this concept has persisted almost to the present day, largely through the influence of Weidenreich (1940, 1943, 1947), who, like Hrdlička, preferred morphological to geological evidence in the dating of fossils. Indeed, there are indications that this concept still lingers in certain quarters, if only in modified form. It is not improbable that Boule's (1913, 1923) appraisal of Neanderthal man was influenced by this hypothesis, despite his clear recognition that actual Neanderthal man could not be a direct ancestor of the modern type of man.

In any event, it is certain that some of Boule's contemporaries regarded Neanderthal man as ancestral to all later hominid forms, and under the influence of the intellectual or philosophical climate in which their studies of human evolution were conducted, it was but natural for them to expect him to be more "simian" and more "imperfect," both cerebrally and posturally, than the later forms of humanity which succeeded and replaced him. This is not an unusual phenomenon. The story of the Piltdown hoax is an even more striking example of the influence of prevailing philosophical climates on scientific thought (Straus, 1954). It seems unlikely, moreover, that we are free from similar influences at the present time. Some of the current appraisals of the Australopithecinae may well prove to be a case in point.

ON THE PATHOLOGY OF THE LA CHAPELLE-AUX-SAINTS SKELETON

Some further observations on the pathology of the La Chapelle-aux-Saints skeleton may not be out of place. As noted, the spinal column, particularly its cervical component, is severely affected by a deforming arthritis. In addition, there exists a flattening and deformation of the right mandibular condyle (the left is not preserved) attributable to an osteoarthritis of the temporomandibular joint. Boule noted a peculiar flattening of this right condyle, but apparently failed to recognize its pathological origin. For he compared the morphology of this condyle to that of a Loyalty Island Melanesian (Fig. 6) which may well have been deformed by a corresponding pathology. We observed an even more severe condylar flattening and deformation in the La Quina and La Ferrassie mandibles, also obviously the result of temporo-mandibular osteoarthritis. Both condyles in the La Quina skull and the left condyle

FIG. 6. DORSAL VIEWS OF RIGHT MANDIBULAR CONDYLES

From left to right, a chimpanzee, the man of La Chapelle-aux-Saints, a Loyalty Islander, an aboriginal Australian, and a modern Frenchman. After Boule (1912).

in one of the La Ferrassie skulls are pathologically distorted; so severe is the extent of the pathological damage in the La Quina specimen that its left condyle is utterly distorted into an appearance of multiple pseudo-exostoses. It would appear that insufficient attention has heretofore been paid to the pathological element involved in the accepted morphology of the mandibular condyle of Neanderthal man. The alveolar borders of the La Chapelle skull underwent extensive resorption during life, so that most of the teeth were lost ante mortem (Fig. 7), a loss clearly recognized by Boule and obviously the result of prolonged and intensive parodontal disease. It is possible that this parodontal disease has a causal association with the pathological deformation of the temporomandibular joints and the consequent distortion of the mandibular condyles.

The limb bones of the La Chapelle skeleton show no evidence of osteoarthritis. However, since a number of the articular surfaces are either absent or incomplete, absolute exclusion of arthritis is impossible. Boule recorded the presence of arthritic exostoses along the margin of the acetabulum in both hip-bone (iliac) fragments and noted that the interior of the left acetabular cavity is glossy and polished—a condition resembling that found in modern men afflicted with coxal osteoarthritis.

Vallois (1949) has stated that chronic osteoarthritis was a specific malady of paleolithic man. He briefly discussed the spinal and coxal osteoarthritis of the La Chapelle-aux-Saints skeleton and indicated, but without supplying details, that this disease is also present in other Neanderthal specimens. It must be realized that arthritis of some sort is an extremely ancient malady. It goes back at least as far as the Mesozoic era, where it has been found in some of the giant, now extinct, reptiles (Moody, 1923). Essentially a disease of skeletal wear-and-tear, its development in a given skeleton may depend upon a complex of interrelated factors. In attempted explanations of its incidence, such factors as genetic predisposition to skeletal trauma, climatic conditions, focal sepsis, and metabolic imbalance have all been invoked, without, however, yielding any satisfactory or convincing conclusion. We can only note here that numerous non-human paleolithic mammals were victims of osteoarthritis and that human skeletons of all known periods, both prehistoric and historic, have suffered from it, regardless of climatic, dietary, and other environmental conditions (cf. Vallois, 1949).

ADDENDUM

After this paper was delivered in New York City, on December 27, 1956, at the symposium commemorating the 100th anniversary of the discovery of Neanderthal man, jointly sponsored by the American Institute of Human Paleontology and Section H (Anthropology) of the American Association for the Advancement of Science, and while it was being prepared for publication, the book by Étienne Patte, *Les Néanderthaliens: Anatomie, Physiologie, Comparaisons*, 559 pp. (Masson et Cie., Paris, 1955), came to our attention. Although dated 1955, it obviously was printed and published in 1956, which explains our failure to consider it in this paper—we simply were unaware of its existence.

Patte deals not only with the skeleton of La

FIG. 7. MANDIBLE OF MAN OF LA CHAPELLE-AUX-SAINTS
Seen from various aspects. After Boule (1912).

Chapelle-aux-Saints, which he regards as the "type" specimen, since it is the most completely preserved, but with other Neanderthalians as well. His book is not primarily concerned with the presentation of new or original observations, but is rather a massive detailed compilation and interpretation of the existing literature dealing with Neanderthal man. That some important relevant publications have been overlooked is not surprising in view of the magnitude of the task undertaken. But all students of fossil man will be permanently indebted to the author for this encyclopedic monograph.

It is particularly interesting that Patte should have arrived at the same conclusion as Arambourg (1955) and ourselves respecting Neanderthalian posture. Thus, he does not believe it justifiable to attribute to Neanderthal man a posture different from that of modern man, adding that "il n'avait pas une démarche de Parisien, mais il n'y a pas que des Parisiens sur terre." His treatment is refreshing in that he compares fossil man with all modern racial groups for which pertinent data are available, and not with Europeans alone, as some previous authors have done and which, for obvious reasons, can be misleading.

Patte's conclusions cannot be given in detail here. It is sufficient, for the present purpose, to note that he agrees with Arambourg (1955) and ourselves respecting the postural significance of Neanderthal vertebral morphology (although he does not stress the osteoarthritic distortion), femoral bowing, tibial retroversion and torsion, and pelvic structure. He falls into the same error as Arambourg, however, when he invokes the Saccopastore skull, which is of early third interglacial age (Howell, 1951), to deny a backward displacement of the classic Neanderthal foramen magnum. Notwithstanding, his claim that the disposition of the lateral semicircular canals in the La Chapelle-aux-Saints skull indicates a carriage of the head not sensibly different from that of an Australian aborigine, is interesting and significant.

That three separate studies—those of Arambourg, Patte, and ourselves—all made at or about the same time, should challenge the orthodox concept of Neanderthal posture, is certainly more than mere coincidence. It represents the results of reinvestigation of a limited range of specialized material in the light of experience gained from more extensive special studies in diverse but correlated fields. It also indicates, perhaps, a recent alteration of the philosophical climate that invests the study of fossil man.

This paper is revised and extended from one presented in a Symposium Commemorating the 100th Anniversary of the Discovery of Neanderthal Man at the 123rd meeting of the American Association for the Advancement of Science, in New York City, December 27, 1956.

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IV. AMERICAN NEANDERTHALOIDS

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THE discovery of the original Neanderthal skeleton in Germany, one hundred years ago, was followed from time to time by reports of putatively ancient American skulls with Neanderthaloid features. The first such report, so far as I can find, bears the date of 1889, only 33 years after the discovery near Düsseldorf. In that year C. L. Webster (1889) of Charles City, Iowa, briefly reported the finding of several primitive-looking skulls in a local mound. Of one skull in particular he stated:

> The skull of this personage was a wonder to behold, it equalling if not rivaling in some respects, in inferiority of grade, the famous "Neanderthal Skull." The forehead (if forehead it could be called) is very low, lower and more animal like than in the "Neanderthal" specimen. (pp. 186–7)

Judging from the accompanying illustration, much of the lowness of the forehead may have been due to the unnatural posing of the head. However, no one today would claim antiquity for a mound skull; yet if any one were so bold as to do so, it is likely that, just as C. L. Webster did, he would need to bolster his claim by referring the skull type to an established form of early man.

Although seemingly unaware of Webster's Iowa Neanderthaloid, Aleš Hrdlička in 1907 disposed of all such American claimants of antiquity mainly on the basis that they did not differ in appearance from modern Indians. At the same time he noted that a large number of recent American Indian skulls have low foreheads and heavy brow ridges. In illustrating this type he placed special emphasis on a Piegan skull from the National Collections (U.S.N.M. no. 243,673) and pictured it in the Broca plane, thereby somewhat exaggerating the frontal slope. Much later, Bell and Hrdlička (1935) described another such skull, this time from Nebraska, and explained that there are

> . . . numerous American crania in which the development of the subfrontal region reminds the observer more or less of the Neanderthalers. Such occurrences do not mean that Neanderthalers were at any time in America, but they do denote the ancestral connection with that type or phase of human development, somewhere outside of America. We are justified in regarding such occurrences as reminiscences, more or less, of earlier stages of the evolution of the human skull, but not as uninterrupted connections, and especially not as any safe index of the antiquity of the specimens that show such characters. (p. 8)

They might have added that the skulls with low foreheads mostly come from the Plains area where such tribes as the Sioux and Arikara lived. These tribes had relatively low skull vaults (Stewart, 1940). Here, then, the low foreheads are simply an expression of the low vaults.

Although Hrdlička was not given to indirection in his criticism, he may have had in mind, when he collaborated with Bell in 1935, a report of an American Neanderthaloid published the previous year in the organ of the American Anthropological association. In the 1934 report George H. Hansen, then Professor of Geology (now Dean of the Graduate School) at Brigham Young University, compared the so-called "Utah lake skull cap" with *Pithecanthropus*, Neanderthal man, Cro-Magnon man, and modern man, concluding that

> The . . . values seem to indicate that from the standpoint of purely physical measurements, the Utah lake skull approaches the upper range of Neanderthal possibilities. (p. 433)

The only evidence supporting this inference of antiquity is the fact that the skull cap was found under 9 inches of heavy lake bottom mud and at a point along the east shore of the lake normally covered by several feet of water. Although a moderate age is possible, the circumstances of the find do not constitute adequate evidence of Pleistocene age.

The illustrations of the skull cap in the original article are too small to be very helpful in forming an opinion about its morphological status. Also,

probably the skull cap is incorrectly posed, for this is certainly true of the *Pithecanthropus* I skull cap shown in the same picture. I will have more to say about this Neanderthaloid farther on.

DEFINITION OF AMERICAN NEANDERTHALOID

It is not my purpose to review the entire literature on the American Neanderthaloids. The few examples cited are for the purpose of explaining the meaning of the term. An American Neanderthaloid may come from anywhere in the Western Hemisphere; essentially it is a skull of uncertain age but with imputed antiquity resulting from favorable comparison with a European Neanderthal. According to this definition, some claimants of antiquity just miss falling into the category. To mention only two: Figgins' *Homo novusmundus*, and Jenks' Pleistocene man of Minnesota, reported in 1935 and 1936, respectively. The first of these was not compared with anything more primitive than upper Paleolithic skulls, but was named as a new species and promptly repudiated by most anthropologists (Roberts, 1937). The second actually was compared with Neanderthal, but was judged to be "... a primitive *Homo sapiens*, of an early type of evolving Mongoloid ..." (Jenks, 1936, p. 177). Obviously it is a fine distinction that keeps such cases out of the category of American Neanderthaloids.

Attention should be directed also to two impressive claimants described within the last ten years: Tepexpan man of Mexico (de Terra, Romero, and Stewart, 1949) and Midland man of Texas (Wendorf, Krieger, Albritton, and Stewart, 1955). Although these latest finds have borne up well under objective tests for antiquity, they have not been represented as Neanderthaloid. Does this mean that the American Neanderthaloids are a phase in scientific thinking which is now past? Perhaps unfortunately, it does not. Evidence exists that there is still an interest in American Neanderthaloids. This interest has received new stimulus from two recent scientific developments: (1) From the C_{14} datings of early man sites in America which yield objective evidence that man reached this continent over 37,000 years ago (for example, Krieger, 1957); and (2) from the discovery in Europe and the Near East of the so-called "progressive or advanced Neanderthals"—that is, skulls mainly of third interglacial age which are not radically different from modern man (Howell, 1951).

To show how these ideas fit together and to demonstrate the continuing interest in American Neanderthaloids, I will draw upon the writings of, and my correspondence with, Professor George Carter of The Johns Hopkins University, who is currently the chief advocate of a considerable antiquity for man in America. Carter claims to have proved the existence of "a lower Paleolithic culture level in America much older than the upper Paleolithic hunting cultures" (1951, p. 307; see also Carter, 1952). Although he considers the age of these lower Paleolithic cultures still speculative, he suggests "that it is time we looked again in the Wisconsin and Illinoian glacial deposits and in the last interglacial deposits for evidence of early man" (1951, p. 307). What this means to him in terms of years is indicated in another statement (Carter, 1950):

> The evidence ... suggests that man possessing the mano, and, by inference, using the metate to grind wild seeds, eating shellfish, and possessed, so far as is known, of only simple stone flakes lived at La Jolla [southern California] something like 40,000 years ago. If the hearths found in the deeper strata are indeed evidence of man, human occupance of this area extends back through the Wisconsin period. One piece of evidence ... associates man with a 25-foot beach level here. If the coast is proved relatively stable, this would indicate interglacial man and probably double the antiquity suggested above. (pp. 101-2)

It is beside the point that Carter's archeological evidence has not been generally accepted; I am simply calling attention to his conviction that the time of man's arrival on this continent is far enough back to include groups in the Neanderthal phase of development.

Carter is aware, of course, of the discoveries of the "advanced Neanderthals" which I have mentioned. This knowledge makes him unhappy about the way the American claimants to antiquity, and especially the American Neanderthaloids, have been and are being handled by the physical anthropologists ("Hrdlička was wrong in all his fundamental criteria, but his conclusion lives on!"—1951, p. 298). Thus he feels certain that, if an actual Neanderthaler of the advanced type turns up in America, it will be dismissed by the neo-Hrdličkas as a modern Indian.

Perhaps as a test of the attitude of the current physical anthropologists Carter asked me to examine the Utah skull cap, described above, which he seems to think is quite old. In this con-

nection I quote from his letter containing this request:

> The skull intrigues me, for I have never seen such brow ridges on so small and delicate a skull. . . . Certainly there is nothing comparable to it from the Southern California area, including the Channel Islands, for I have handled several hundreds of skulls from this area and none resemble this one.

Whether or not Carter would define a Neanderthaler solely on the bases of brow ridges, I do not know; he may have been hoping that I would find something else to clinch the identification. Be this as it may, his request placed me in a dilemma: If I said the skull was modern in type, I could be called a neo-Hrdlička; if I said it was Neanderthaloid, I would be going against my convictions that morphological dating is a poor substitute for geological and cultural dating (Stewart, 1949). So finally, after having examined the skull, I wrote to Professor Carter as follows:

> . . . the type represented is not foreign to recent Indian populations. Further description of this specimen would involve morphological dating. If the geologists can date the stratum in which this skull was found and show that the latter was a natural inclusion in this stratum, then will be the time for a further description of the skull. (Correspondence bearing U.S.N.M. file no. 207,544)

Needless to say, this incident gave me something to think about. Where my thinking has led will now be outlined.

To begin with, I see no point in repeating the old arguments as to whether man could or could not have reached America in one of the interglacial periods. The fact is we still do not know what happened. Only thirty years ago there was scarcely any acceptable cultural and geological evidence in this hemisphere for a human antiquity of 10,000 years; but today we have considerable evidence for twice, and some for thrice, that age. The more extreme C_{14} dates and the archeological findings of Carter may be suspect, but they have not yet been disproved; and who can say what is still to be discovered. Moreover, northeast Asia has scarcely been touched by archeological exploration. We know almost nothing about primitive human types there, beyond the significant fact that *Sinanthropus*, a less advanced type even than Neanderthal, was in existence in northern China during the Middle Pleistocene (Woo, 1956). In view of these considerations I feel that we should keep an open mind about the presence in America of ancient *sapiens* and pre-*sapiens* types. All of which does not mean that we should not continue to apply the tests of antiquity to finds of this nature.

ANALYSIS OF NEANDERTHAL CONCEPT

This brings us to the crux of the problem: To what extent can we rely on physical type, and particularly the Neanderthal type, to help establish the antiquity of man in America? To answer this question we must look closer at what has happened to the Neanderthal concept during the past hundred years. The original Neanderthal skeleton was not dated, either geologically or culturally, at the time of discovery. The same was true of the Gibraltar skull found earlier. So when in 1869 the Gibraltar skull was resurrected (so to speak) and recognized as a pre-*sapiens* type, it only helped confirm that the Neanderthal type was normal and not due to some pathological condition. Thus the antiquity of the Neanderthal type remained in the realm of personal opinion until the discovery of the Spy skeletons, with their paleontological and cultural associations, in 1886, almost thirty years after the discovery near Düsseldorf. Incidentally, these facts have a bearing on the date (1889) of Webster's Iowa Neanderthaloid mentioned at the beginning: Webster must have been following these developments quite closely.

The Spy discoveries also helped establish an association between the Neanderthal physical type and the Lower Paleolithic industry known as Mousterian (the concept of the Mousterian has also undergone a change, but I shall not go into this). By 1924, with the further development of the cultural association, MacCurdy could say with assurance:

> Neanderthal is the equivalent of Mousterian man [because] the skeletal remains of this type are associated with the Mousterian industry and belong to the Mousterian Epoch. (Vol. 1, p. 305; quotation rearranged)

Hrdlička used much the same wording in his definition of Neanderthal in his Huxley Memorial Address of 1927, namely,

> The only workable definition of Neanderthal man and period seems to be, for the time being, *the man and period of the Mousterian culture*. An approach to a somatological definition would be feasible, but might for the present be rather prejudicial. (1929, p. 251)

Most textbook writers of this period avoid giving a definition and pass directly to the description of specimens. Thus the next definition which I find is that by Weidenreich (1943). Here the emphasis is very different:

> Neanderthal Man, Neanderthaloids or Neanderthalians pass . . . as a collective name for all hominids between those types which already possessed the characteristics of man—as, for example, Cro Magnon or Aurignac—and *Pithecanthropus*, considered as ranging close to the anthropoids. (p. 233)

By contrast, Ashley Montagu in 1951 brought together in his definition a summary of opinions about this early man:

> Neanderthal man is essentially an Upper Pleistocene, late Early, and Early Middle Paleolithic form of man, one whose physical characters and mental potentialities have most probably gone into the making of ourselves, and who ends the long line of paleanthropic types as distinguished from the early and late neanthropic types. (p. 155)

Clark Howell, also in 1951, tacitly recognized the problem of definition, for he stated simply that he was dealing with skulls *called* Neanderthal. He then proceeded to subdivide the specimens bearing this name on the basis of time into (1) interglacial Riss-Würm Neanderthals, and (2) Western European Würm I Neanderthals, or, to use popular terms, "advanced" and "classical" Neanderthals, respectively.

The quoted definitions, as arranged in chronological order, reflect expanding knowledge with concomitant loss of simplicity. Time, once expressed in narrow cultural terms, is now stated in terms of continental glaciation, with implications of ecological changes. Type, on the other hand, has never been spelled out, except for being something outside the range of modern man and not so extreme as *Pithecanthropus*. Still unsettled is the amount of overlap in time between the *sapiens* and Neanderthal types.

Now how has this vague concept served on the operational level? Some selected examples will show. Exploring the Shanidar Cave in Iraq in 1953, Ralph Solecki dug down through a great depth of deposits to a Mousterian-type culture level and there found the remains of a child (actually only the enamel tooth caps are well preserved). It is noteworthy that in his formal report of this work Solecki (1955) is careful to avoid characterizing the physical type of the child. He comes nearest when he says:

> Whether or not the Shanidar child will ever fill the evolutionary gap between *Homo sapiens* of the Aurignacian of Palestine and the "human type which is morphologically intermediate between Neanderthal and modern man" of the Levalloiso-Mousterian of Mount Carmel . . . remains to be seen. (p. 421)

In this case, time, as indicated by culture level, seems likely to be the primary factor in the interpretation of the human remains; physical type probably will be secondary (for immaturity and poor preservation of the remains will limit their significance).

We will go back to 1918 for a second and contrasting example. In that year Sir Arthur Keith saw a research report by Dr. G. Despott, Curator of the Natural History Museum in Malta, describing the latter's excavations in the cave of Ghar Dalam. In the report was a photograph of eight human teeth, two of which impressed Keith as being Neanderthal. Solely on the basis of the appearance of these two teeth, and nothing in the way of cultural or geological evidence, he announced the presence of Neanderthal man on Malta. Later (Keith, 1924) he defended his earlier precipitate announcement by showing that the teeth are taurodont (i.e., they have relatively large pulp cavities). Here, in contrast to the Shanidar example, physical type (if taurodontism can be so characterized) is the primary factor in the interpretation of the human remains; time in the form of cultural evidence is secondary (or non-existent).

I am not aware that anyone, with the possible exception of Senyürek (1939), has criticized Keith for making this claim. According to Senyürek, Keith, like Adloff before him, maintained that early forms with enlarged pulp cavities could not be ancestral to modern man, and we now know this to be incorrect; even such modern forms as Egyptians and American Indians often exhibit the condition. Furthermore, no evidence of Mousterian man has been found on Malta since 1917 to support Keith's claim (personal communication from J. B. Ward Perkins). In America we can probably find many Neanderthals if we use taurodont teeth as the sole criterion of physical type: but we may never find a single Neanderthal, if we use the Mousterian industry as the sole criterion of his presence. The Mousterian industry

has been traced eastward only to the borders of Asia. As for eastern Asia, Movius (1949) has presented the intriguing argument that the cultures of that area developed out of a quite different stone-age background.

For our third example I direct your attention to the skull of Rhodesian man, found accidentally in an open mine in Northern Rhodesia in 1921 (Hrdlička, 1930). Weidenreich (1943) regarded the Rhodesian skull as a representative of a separate regional and typological group of Neanderthals, a group more primitive even than the classic Neanderthals of Europe. Although the Rhodesian specimen is undated, its distinctive appearance has left no doubt as to its antiquity. If such a specimen were to turn up in America under similar circumstances, doubtless we too would have no doubt about its antiquity.

Again for contrast let us consider one more example. In 1935–36 the back part of a skull was found at Swanscombe, England, as an indigenous fossil of the 100-foot Terrace of the Lower Thames (Hinton et al., 1938). The accompanying culture is Acheulian (i.e., the stage preceding Mousterian); the associated fauna is interglacial in type and assigned to the Mindel-Riss interval). Although the skull is clearly dated and quite ancient, its type remains in doubt, because the front parts are still missing. Evidently, then, Swanscombe is the reverse of Rhodesian, just as Shanidar is the reverse of Ghar Dalam; in other words, Swanscombe is dated but not typed, whereas Rhodesian is typed but not dated. Nevertheless, if a specimen of undetermined type such as Swanscombe were to turn up in America with such good evidence of antiquity, doubtless we too would accept it as an important find.

RECOMMENDATION

From these considerations I think it is clear that great caution should be used in applying the terms Neanderthal or Neanderthaloid to skeletal remains found outside Europe. These terms still carry implications that can be erroneous in a different setting, and especially in the New World. Nevertheless, thus far the Neanderthal group provides the only indications of the physical characters which we may yet encounter, if it turns out that a pre-*sapiens* type of man actually reached America. For these reasons I recommend the following terminological restrictions: *Apply the terms Neanderthal and Neanderthaloid to American finds only (1) if the specimen in question can be clearly distinguished in type from modern man and is of an age at least as old as the Mousterian industry in Europe, or (2) if the specimen is undated but possesses characters at least as extreme as those of the classic European Neanderthals.*

If this recommendation is followed, I venture to predict that the reporting of an American Neanderthaloid will become a rare event, but at the same time an event rivaling in importance the century-old find at Düsseldorf. On the other hand, I am not implying by this recommendation that a skull found in America must have primitive morphological features before it can be considered really old. In the absence of clear-cut evidence of this sort the claimants of antiquity must have geological and, if possible, cultural validation.

This paper was presented at a Symposium Commemorating the 100th Anniversary of the Discovery of Neanderthal Man during the 123rd meeting of the American Association for the Advancement of Science, in New York City, on December 27, 1956.

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NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will occasionally appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to H. B. Glass, Associate Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland, U. S. A.*

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GENERAL BIOLOGY: PHILOSOPHY AND EDUCATION

THE PHILOSOPHY OF SCIENCE. *Part 1. Science in General. Duquesne Studies, Philosophical Series 6.* *By P. Henry van Laer, with Henry J. Koren. Duquesne University, Pittsburgh.* $3.75 (cloth); $3.00 (paper). xvii + 164 pp. 1956.

The author of this book is a professor at the State University of Leyden (Netherlands), and the text is based upon lectures he has given in Holland and also at Duquesne University in Pittsburgh. Henry J. Koren assisted in the preparation of the material for publication. A second volume, which will complete the work, is promised.

As a contribution to the study of philosophy of science, this book presents a rather specialized viewpoint. It would seem, therefore, that to call the book "A Philosophy of Science" would more accurately reflect its contents than the title with the definite article.

The text is didactic and, in this volume at least, emphasizes logic rather than experiment. Except for a few bibliographical footnotes, there is no bibliography. Perhaps documentation is reserved for the second volume.

MORRIS C. LEIKIND

SCIENCE AND FREEDOM. *The Proceedings of a Conference Convened by the Congress for Cultural Freedom and Held in Hamburg on July 23–26, 1953.*

Beacon Press, Boston. $4.50. 295 pp. 1955.

The Hamburg Congress for Cultural Freedom was notable as the first of its kind—let us hope sincerely that it will not be the last. The murky smog of the Cold War necessitates such efforts to clear the atmosphere.

The volume of Proceedings includes some 20 papers, presented in 5 sessions, together with the subsequent discussions following each. The sessions were focused on The Organization of Science, the relations of Science and the State, Science and its Method, Science in Chains, and the relation of Scientist and Citizen.

The chief difficulty seems to arise from the excessively short lengths imposed on the papers. In spite of that restriction, several papers are well worth the time of every biologist. John R. Baker has much crisp common sense to say in his essay on Freedom and Authority in Scientific Publication; the section on Science and the State raises grave problems; and the section on Science in Chains devotes special attention to the tyranny of dialectical materialism over science in the Soviet Union. In the section just named, Theodosius Dobzhansky recounts The Fate of Biological Science in Russia, while Sidney Hook and

others deal with more general relations of dialectical materialism to the theory and practice of science.

This is a book that unfortunately will probably not get nearly as wide attention as it deserves. The work of Michael Polanyi, Chairman of the Organizing Committee, and his fellow-workers is going forward through the continuing work of the Committee on Science and Freedom, which publishes several bulletins each year on significant issues and developments, and serves to maintain contact between all scientists concerned about the issue of scientific freedom. Biologists, take note!

BENTLEY GLASS

SCIENCE AND CHRISTIAN BELIEF. *The John Calvin McNair Lectures.*

By C. A. Coulson. University of North Carolina Press, Chapel Hill. $2.50. x + 127 pp. 1955.

In the train of a distinguished group of predecessors including David Starr Jordan, John Dewey, E. G. Conklin, R. A. Millikan, Arthur H. Compton, William E. Hocking, Kirtley Mather, and E. W. Sinnott, a noted British professor of applied mathematics at Oxford here tries in his turn to cope with the problem posed in the title of this book. These four lectures may be regarded as the answer of the Christian scientist to the attack made by Homer W. Smith in *Man and his Gods* (1953). Beautifully written and skilfully reasoned, the argument cuts more directly to the heart of the problem and carries greater conviction than any previous work of the kind I have read.

Coulson is particularly severe in condemnation of those who try to restrict science and religion to separate, inviolate spheres. Experience clearly shows that all such boundaries tend to shatter with time. Their very existence is an invitation to science to extend the area of its proper investigations. In the author's view, science and religion deal with the same whole. Science reveals God, immanent in Nature, not interfering with it like an outsider because He is it. Like Max Planck, Coulson believes that science and religion are fighting a joint battle "against scepticism and against dogmatism, against disbelief and against superstition." If, then, the "religious view of man is not separate from or contrary to, the scientific [but] is the act of reflection and total response, not only to the scientific view, but to all other forms of revelation accessible to [us]," where does Christian belief fit into this frame of thinking?

If our sense of the unity of life must be combined with a recognition of the gross inadequacy of any one discipline or view to express that unity, if inspiration and revelation must unavoidably be added to rationality, we arrive through synthesis of the scientific and religious views at a kind of pantheism. If we recognize further the personal character of reality—"if it be true that truth can only be expressed in personal terms, and if it be true that all partial truths have a link which binds them together in the response of persons to God as He is revealed in the panorama of their environment, then it is not unreasonable to suppose that the whole process may be gathered up in one person—a representative person, an archetype—in whom the truths of nature and the truths of people find their meaning .... The Christian claims that this event has taken place in Christ."

It is impossible to present the argument and the spirit of these discussions more than very imperfectly in so brief a résumé. Suffice it to say that the argument for a synthesis of the religious attitude and the scientific spirit have never been more persuasively set forth.

BENTLEY GLASS

THE GIFTED STUDENT AS FUTURE SCIENTIST. *The High School Student and His Commitment to Science. By Paul F. Brandwein. Harcourt, Brace & Company, New York.* $2.00. xviii + 107 pp.; ill. 1955.

At the present moment the revived concern about the failure of the United States to make adequate use of its scientific manpower and to train sufficient numbers of scientists and engineers ought to direct renewed attention to this book. Here Paul Brandwein, one of the country's most distinguished secondary school teachers of science, analyzes forcefully the real heart of the educational problem. How to identify the potential scientist in early years and how to instil the necessary devotion and enthusiasm are questions far more basic than the palliatives generally recommended can relieve.

Drawing on his own personal experience, Brandwein emphasizes that a high-level ability in science depends on a concurrence of factors, no one of which is sufficient, though all are necessary. There are certain *genetic* factors, which involve particularly high verbal ability and high mathematical ability, besides inescapable neuromuscular and sensory competence. There are "predisposing" factors, among which the most significant appear to be qualities of *persistence* and *questing* (scientific scepticism and curiosity). There is finally an *activating* factor involving the opportunities for advanced training and for contact with an inspirational teacher.

Brandwein further explores the ways of testing for these factors, which may be done to reasonable satisfaction even now. If the methods already available were used as they could be, the identification of promising students should be the easiest part of the problem to solve. The crux of the difficulty revolves around the teacher. Brandwein finds the same factors

to be requisite for a successful science teacher as for an able science student, but the nature of the "activating factor" appears to be somewhat different. It is opportunity to teach, rather than opportunity for advanced study, that becomes significant, and successful relations with the able students seem almost always to involve maturity, combination of a sympathetic attitude toward the student with a firm maintenance of high standards of achievement and behavior, and fulfilment of a "father" or "mother" image in the mind of the child. The big task is to retain such teachers in the schools in competition with industry, government, and other professions, which pay more at the outset, advance the successful individual more rapidly, and provide greater economic security and social prestige.

Brandwein proposes remedial action through a local, state, and national program aimed to coordinate the effort in the secondary schools with that in the colleges. His program is modest but would undoubtedly go a long way to improve matters. It will be a tragedy if the bodies concerned with action to increase scientific manpower in the nation fail to take heed.

BENTLEY GLASS

LIFE, THE GREAT ADVENTURE.

By Jean Rostand and Paul Bodin; foreword by Marston Bates. Charles Scribner's Sons, New York. $3.50. xii + 228 pp. 1956.

This book is based on a series of French radio programs which was obviously intended for an intelligent lay audience. Author Paul Bodin, in the role of the intelligent and somewhat informed layman, poses questions on a variety of biological topics to Jean Rostand, the scientist-philosopher-humanist, who supplies the answers. The twelve dialogues between these gentlemen grow out of the unanswerable questions of Gauguin: "Where do we come from?" "What are we?" "Where are we going?" Ranging from the origin of life to the inevitable extinction of the human race (and indeed, of all life on earth), the discussion touches many aspects of human biology and medicine—the evolution of man, his development and heredity, the role of environment and the general biological and social improvement of man to the degree possible. A number of side issues—such as Rostand's musings on faith healers, the freezing of human sperm, and the potentialities of human parthenogenesis—enhance the main topics.

The dialogue form of presentation lends itself well to a general survey-review of this type; it is preferable by far to straight exposition. One could wish for a little more spontaneity, however; for many of Bodin's questions merely ask for clarification of Rostand's earlier writings. Bodin also seems content to accept, without rejoinder, Rostand's answers to a number of highly controversial items to which alternative views or interpretations cry for expression.

Rostand's information is only occasionally in error or out of date. In matters of opinion, especially where possible action toward a desirable end is discussed, some of his views would no doubt be met by considerable opposition from other biologists. But to his credit it must be said that he takes a strong and unequivocal stand against beliefs and endeavors for which there is no demonstrable proof or justification. Extra-sensory perception, metapsychics, astrology, and belief in physical immortality all meet his scornful gaze; but he rightly does not close his mind to further evidence within these areas.

In short, this book may be used by the layman as a "first reader" in human biology; but it will also provide an opportunity for the seasoned biologist to reexamine some of his own beliefs, as well as to pass a pleasant evening.

FRANK C. ERK

CELLS AND SOCIETIES.

By John Tyler Bonner. Princeton University Press, Princeton. $4.50. vi + 234 pp. + 8 pl.; text ill. 1955.

This book undertakes to emphasize the one-ness and the complex interrelations between living organisms by describing first a number of animal societies, then various colonial aggregations, and finally individual multicellular organisms. The theme is thus the biologically well-known analogy between the place of the individual in a social group or colony and the place of the single cell in the many-celled plant or animal. By starting with such social groupings as a band of howling monkeys, a herd of fur seals or of red deer, or a family of beavers, Bonner takes the reader painlessly from familiar things to the more foreign ways of social insects and colonial hydroids. Once down the scale to single-celled plants and animals, the author climbs the ladder of multicellular organization, in a series of chapters entitled Energy, Matter, and Cells; Feeding in Plants; Reproduction and Development in Plants; Coordination in Plants; Feeding and Digestion in Animals; Breathing in Animals; Circulation in Animals; Excretion in Animals; Development and Reproduction in Animals; and Coordination in Animals. The final chapter, on Human Societies, is culmination and résumé.

In many respects the pattern of this book resembles one written by E. W. Sinnott, *Cell and Psyche*, although the purposes of the two authors are so very different. In Bonner's book there is no overtone of concern about the mind-body problem, no concern about vitalism and mechanism, no religious or philosophical striving to see beyond the evolutionary process. On the other

hand, Bonner would do well to handle fact with Sinnott's accuracy and like Sinnott to write with dignity and force as well as clarity. The style here seems colloquial to the point of carelessness, and faults of grammar and diction are all too frequent.

BENTLEY GLASS

BIOLOGY. *3rd Edition.*

By Claude A. Villee. W. B. Saunders Company, Philadelphia. $6.75. xx + 615 pp.; ill. 1957.

This new edition of Villee's general biology textbook again places strong emphasis on the anatomy and physiology of the human body, although perhaps not quite so much as in the preceding edition. The coverage of material in biology is very extensive and may be too much for an elementary text. However, it should be possible to select material from the book to correspond with the lectures in a course, and the rest is there for students to browse through.

The illustrations are abundant and quite good, especially some of the electron microscope photographs. One excellent feature is the inclusion of a number of recent significant and critical experiments in various fields, as for instance the isotope experiments which showed that the nucleic acid of a bacteriophage enters the bacterium, whereas the protein coat does not.

The whole book, however, suffers from compression. There are enormous numbers of facts which are well organized, but the organization is too apparent. Most of the book consists of simple declarative statements laid out in sequence for temporary memorization. The biological and scientific principles are separated out (as simple declarations) in a chapter by themselves, rather than illuminating and tying together all of the factual material throughout the rest of the book. Even the recent and exciting experiments are presented as a news report would be, without any editorial effort to explain for the beginning student in what ways the experiments were exciting or elegant or critical. While the book gives a fine summary of the material of biology, and some idea of the uses of biology, it is a very poor introduction to the science of biology as a human activity.

A. T. JAGENDORF

BIOLOGY AND ITS RELATION TO MANKIND. *Second Edition.*

By A. M. Winchester; assisted by B. J. Kaston. D. Van Nostrand Company, Inc., Princeton. $7.25. x + 902 pp.; ill. 1957.

The second edition of the textbook first put out by A. M. Winchester (*Q.R.B.*, 24: 346. 1949), and now revised with the assistance of B. J. Kaston, has been very extensively rewritten. The present edition is 10 or 15 per cent larger than the first. Like its precursor, it is a very readable and very well illustrated textbook; many of the illustrations are from photographs taken by Winchester himself. The text is designed for an introductory course in the biological sciences, particularly for biology courses that are part of a liberal arts program.

It appears to me, however, that introductory textbooks for today's college students indicate the prevalent laxity and decline of standards in college education. Twenty years ago, such material as is presented in current introductory college textbooks would have been thought suitable for second-year high school students. This remark is not intended as a specific criticism of Winchester's book, but rather of the general trends in so-called higher education. The book itself constitutes a distinct improvement over the first edition and is certainly one of the better textbooks in its area. I am particularly glad that the illustrations of an Indigo Snake and Friend and of Muscular Coordination are retained, though I do miss that most charming illustration of Vitamin D Manufacture. I hope to find it once again in a third edition of this otherwise good textbook.

DAVID B. TYLER

A MILLION YEARS OF HUMAN PROGRESS. *Revised Edition.*

By Ira D. Cardiff; introduction by Melvin A. Brannon. Pageant Press, New York. $2.50. xii + 146 pp. 1955.

This book might well be subtitled "A Pocket Book of History." Without attempting more than to sketch what his concept of human history might become in a definitive work, the author has tried to deal with human progress through technological advances, inventions, scientific discoveries, and developments in the realm of pure ideas. Starting with Dawn Man, he adds upright posture, the discovery of the lever, the production of stone implements, the opposable thumb (rather out of sequence!), knife, spear, and clothes, the bow, fire, tillage of the soil, domestication of animals, and articulate speech. He places emphasis on the development, in classical times, of logic, ethics, mathematics. In modern times the history of science assumes a significant role, and biology is represented, even in so brief a treatment, by the discoveries of the circulation of the blood, the cell, fertilization, evolution, anaesthesia, the role of bacteria, mendelian heredity, phagocytosis, antibodies, vitamins, psychoanalysis, and the like. The most recent period is characterized not only by atomic fission, the spread of Communism, and the establishment of the United Nations, but also by antibiotics and by changes in morality and the birth of a new, modern philosophy.

This should be a stimulating semipopular book, well calculated to stir the mind of the high school student. It would be magnificent if we could have a really full-scale treatment of history along these lines, but since H. G. Wells no one has been bold enough to attempt it. Professional historians, with few exceptions, stick to political, economic, and social developments. Technological changes may creep into their pages now and then; the history of ideas and the dependence of human progress on advances in the basic knowledge of the nature of the world, hardly ever. Is one reason why basic science receives so puny a support in the United States, in spite of general acknowledgment that technological progress and national strength depend upon it, not to be found in the fragmentary, the nearly non-existent consideration it receives in our teaching of history?

LABORATORY MANUAL IN BIOLOGY.
By Paul B. Weisz. McGraw-Hill Book Company, New York, Toronto, and London. $3.00 (paper). viii + 183 pp. 1955.

Conventional in its selection of laboratory exercises, this manual is in one respect quite unusual. Each exercise possesses a lengthy section, entitled Analysis, in which the major objectives of the exercise are reviewed by means of questions, problems, and further observations. The study of reproduction and sexuality, which combines observations on gametogenesis, mating, and fertilization in algae and fungi, the mating reaction and conjugation in *Paramecium* and *Blepharisma*, and observations of sexual development in *Hydra* and *Obelia*, deserves note.

BOTANY. *A Laboratory Manual. Second Edition.*
By T. E. Weier, C. R. Stocking, and J. M. Tucker. John Wiley & Sons, New York; Chapman & Hall, London. $2.95 (paper). vii + 175 pp.; ill. 1957.

WORKBOOK IN FUNDAMENTALS OF PLANT SCIENCE.
By George B. Cummins, George A. Gries, Samuel N. Postlethwait, and Forest W. Stearns. Burgess Publishing Company, Minneapolis. $3.00 (paper). ii + 134 pp.; ill. 1956.

LABORATORY MANUAL FOR GENERAL BOTANY.
By Wilson N. Stewart and Harry J. Fuller. Henry Holt & Company, New York. $2.25 (paper). x + 62 pp. + 18 pl.; text ill. 1956.

ZOOLOGY LABORATORY MANUAL. *Second Edition.*
By A. M. Winchester. Wm. C. Brown Company, Dubuque. $2.75 (paper). vi + 228 pp.; ill. 1955.

LABORATORY MANUAL, GENERAL BIOLOGY.
By E. F. Castetter, W. J. Koster, H. J. Dittmer, and M. W. Fleck. Burgess Publishing Company, Minneapolis. $3.00 (paper). vi + 73 pp. + 58 pl. 1956.

GENERAL BIOLOGY LABORATORY GUIDE.
By A. Paul Davisson. Burgess Publishing Company, Minneapolis. $3.75 (paper). vi + 160 pp.; ill. 1956.

LABORATORY MANUAL FOR GENERAL BIOLOGY.
By Willis H. Johnson, Richard A. Laubengayer, and Louis E. DeLanney. Henry Holt & Company, New York. $2.75 (paper). x + 174 pp.; ill. 1956.

GRINNELL WORKBOOK IN BIOLOGY.
By the Biology Staff, Grinnell College, Grinnell, Iowa; edited by Norman H. Russell, Jr. Burgess Publishing Company, Minneapolis. $1.75 (paper). iv + 56 pp. + 12 pl. 1956.

ILLUSTRATED LABORATORY MANUAL FOR PRINCIPLES OF BIOLOGY-1.
By William H. Behle, Lewis T. Nielsen, and George F. Edmunds. Burgess Publishing Company, Minneapolis. $1.50 (paper). iv + 51 pp.; ill. 1956.

GENERAL BIOLOGY MANUAL. *Part I.*
By Otto E. Kugler and John F. Glawe. Burgess Publishing Company, Minneapolis. $2.25 (paper). ill + 103 pp.; ill. 1956.

These laboratory manuals have been prepared, in general, for the particular courses taught by the respective authors; each presumably could be adapted for courses elsewhere. The first three manuals are for courses in general botany, Winchester's manual is for general zoology, and the remaining six are for general biology. All use the question-and-answer approach, all have drawings to be labelled or to be made, and all have spiral wire bindings. From the first to the last in the list, they are designed for courses given at the following colleges or universities: University of California at Davis, Purdue University, University of Illinois, John B. Stetson University, University of New Mexico, Fairmont (W. Va.) State College, Wabash College, Grinnell College, University of Utah, and University of Illinois. No single one can be recommended above the others, for the usefulness of such manuals greatly depends upon the particular laboratory instructor.

C. P. SWANSON

HANDBOOK OF BIOLOGICAL DATA.
Edited by William S. Spector; prepared under the direction of the Committee on the Handbook of Biological Data, Division of Biology and Agriculture, The National Academy of Sciences, The National Research Council. W. B. Saunders Company, Philadelphia and London. $7.50. xxxvi + 584 pp.; ill. 1956.

ANNUAL REVIEW OF PHYSIOLOGY. *Volume 18.*
Edited by Victor E. Hall; associate editors, Frederick

A. Fuhrman and Arthur C. Giese. Annual Reviews, Stanford. $7.00. viii + 591 pp. + 1 pl. 1956.

ANNUAL REVIEW OF BIOCHEMISTRY. *Volume 25. Edited by J. Murray Luck; associate editors: Frank W. Allen and Gordon MacKinney. Annual Reviews, Palo Alto.* $7.00. x + 794 pp. + 1 pl.; text ill. 1956.

The modern biologist is faced with a kind of paradox. On the one hand, his immediate reputation and productivity ("publishability") is related to the narrowness and intensity of his research interests. On the other hand, the probability of a really novel discovery is almost always greatest in the border area between two disciplines. The practical question is, "How can one best meet the dual responsibility of being a specialist, on the one hand, and of having a broad knowledge of biology or of science in general, on the other?"

One can, in keeping with the industrial practices of the times, organize a team of specialists, each of whom is abreast of developments in a restricted area. Such an effort is, in my opinion, severely limited; for although a group of specialists is an ideal repository for a vast amount of detailed knowledge, the novel synthesis of ideas that alone leads to original experiment is still predominantly an individual enterprise. Alternatively, the individual can make use of the various systematic attempts to collect, collate, and correlate the published data in given narrow or broad fields of science.

The ease with which one can assimilate new data, and the more important generalizations springing from them, depends to a great extent upon how well the reviewer adheres to the following rules: (1) define terms and concepts at the beginning; (2) separate the reliable from the unreliable; (3) classify, categorize, and synthesize into coherent, orderly structure; and (4) give some impression of the frontiers and areas in which important generalizations may be found.

If decipherable, critical, synthetic, and analytical reviews were available in the various branches of biology, the task of "keeping up with the literature" would be greatly simplified. The three books here reviewed meet these particular criteria to varying degrees.

The *Handbook of Biological Data* carries as its motto the following quotation from A. N. Whitehead: "Without generalization there is no meaning, and without concreteness there is no significance." Yet only the last half of this statement is perceptibly appropriate. The book is primarily a collection of data and has little usefulness as a source of biological generalization. This may be because generalization is ill-suited to tabular presentation. As a sourcebook of detailed quantitative information on various biological subjects, it is a moderately to highly successful enterprise. Some of the data appear to be of limited general use, although interesting to read, e.g., selected arthropod pests, selected fungal parasites, male genitalia (dimensions and weight, mammalian), toxic marine organisms, liver function tests (man). One of the most serious disappointments of the volume is the relative absence of structural formulae for compounds of biological interest and the absence, except in a few cases, of adequate diagrams indicating metabolic interrelationships. The lack is particularly unfortunate in view of the elaborate attention given to structural formulae of other biologically less important compounds, e.g., antihistaminics, plant growth regulators, etc. Finally, while it would be impossible to include detailed literature references, it might be desirable for each major table to refer to one or two comprehensive reviews as monographs in the field under survey.

The *Annual Review of Physiology* and the *Annual Review of Biochemistry* are generally desirable volumes for specific reference purposes and as sources of detailed bibliographies in certain areas. The review of reviews is a foolhardy business, so rather than try to summarize in a couple of paragraphs the essence of these volumes, I shall dwell upon what were, for me, high points. The introductory chapters of both volumes were interesting and stimulating, the former by B. A. Houssay, the latter by B. S. Platt and written in momory of Sir Edward Mellanby. Houssay's chapter, Trends in Physiology as seen from South America, contained some thoughts that appear well worth quoting.

> There is a rapid growth and differentiation [of physiology] into many branches, so that it is not possible for one person to have complete and detailed knowledge of the whole field. The integration of this huge amount of knowledge is becoming increasingly difficult, but it is ever more necessary to achieve this integration, and the achievement is by no means impossible. . . .
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> Research technique is becoming increasingly difficult, specialized and limited. Subdivision of science is necessary for progress, but this increases the importance of not forgetting that all this knowledge must finally be integrated in order to understand the functioning of the organism as a unit. . . .
>
> There is no science without generalization. Scattered facts are as grains of dust or steel which can neither be counted nor held together; welded together these can be made into bricks or girders and put together in an orderly way so as to raise a building. . . .
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> Physiology sails its ship between the Charybdis of premature, undemonstrated generalization, and the Scylla of unimaginative fear of hypothesis and synthesis. In Latin America the greater danger is to be found in uncontrolled phantasy. . . . In other, more advanced countries, there is an almost superstitious belief in facts and statistics and a horror of hypothesis. Imagination, one of the great powers of the mind, is not only desirable, but absolutely necessary for the advancement of science. . . .
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> Frequently a single worker cannot master all the techniques needed to solve a particular problem, the cooperation of experts in several fields becomes indispensable, and the development of the central idea guiding the work has to be carefully planned. Great original discoveries are, and always will be, the fruit of single outstanding minds; aid should be given to capable men rather than to elaborately planned projects. . . .

Compare with these the dictum: "Don't plan vast projects with half-vast ideas."

Two articles, one on Neoplastic Growth, by Klein, in the *Annual Review of Physiology*, and one on the Biochemistry of Cancer, by Heidelburger, in the *Annual Review of Biochemistry*, present contrasting pictures of approaches to the cancer problem. Both reviews are well worth reading for a statement of the kind of work now being done on the biology of neoplasms. Both present interesting data; both are good collections of bibliography; and both are less concerned with an analysis of the significance of data than with an enumeration of claims. One wishes that such reviews were directed more toward a testing of general ideas, a projection of hypothesis, and a critique of the evidence, rather than toward a listing of publications.

One of the most interesting papers in the *Annual Review of Biochemistry* is that by Seymour Korkes, who died in an automobile accident in December, 1955. The unfinished review was completed by a group of Korkes' friends who surely must constitute the most eminent collection of individuals ever to contribute to a single review article (M. L. Byrne, S. P. Colowick, P. Handler, B. Z. Horecker, N. O. Kaplan, S. Kaufman, F. Neuhaus, and G. W. Schoest, Jr.). As one who became acquainted with and was impressed by Seymour Korkes while still in graduate school, I can only concur in the "deep regret that the incisive thought and imagination of the original author has been lost to Biochemistry." The article is critical, imaginative, and analytical, as its author was.

BERNARD L. STREHLER

BIOLOGY: HISTORY AND BIOGRAPHY

VERERBUNGSWISSENSCHAFT. *Orbis Academicus.* *By Alfred Barthelmess. Verlag Karl Alber, Freiburg and München.* DM 23.–. x + 429 pp. 1952.

Although this book has come belatedly to attention, it is of such significance that even now a review appears highly desirable. The intention of the author is not at all to present a survey of modern genetics, but rather to trace the history of human ideas about biological inheritance. No book of this kind, needless to say, has previously been written.

The author commences with a consideration of Hippocrates and Aristotle, as the fathers of scientific concepts of heredity. Here, as throughout the book, the author's own comments are secondary to a selection of materials which convey in direct translation or original language the concepts of the forerunners of modern ideas. This chapter, though very brief, effectively presents the analogy between Aristotle's "entelechy" and modern "organismal" views, but seems to miss the equally significant parallel between Aristotle's "dynamis" and the genotype.

A second section of the book deals with ideas of constancy and modifiability, as seen in the concepts of reproduction and development held by Harvey, Haller, and Wolff, of species and classification, as seen in Linnaeus, Koelreuter, and Gaertner, and of evolution, as seen in Erasmus Darwin, Lamarck, and Charles Darwin. What a pity that Bonnet and Swammerdam, Redi and Spallanzani, Buffon and Maupertuis are not here fitted into place!

Mendel receives a chapter to himself, and this is followed by one entitled Gestalt und Gehalt, which deals first with Haeckel; then with the concept of the idioplasm as the hereditary substance, whether in cytoplasm (His, Flemming, Weismann) or in nucleus (Hertwig, Flemming, Boveri, van Beneden, Naegeli, Roux, and Weismann); and finally with hypotheses of heredity and development (Hering, Spencer, Darwin, Galton, Naegeli, Strasburger, de Vries, Weismann, Rhumbler, Reinke, Roux, and Driesch).

The final section, comprising over one hundred pages of the book, is entitled Vorherrschaft der experimentellen Forschung, and deals first with Idiogenetics, or the theory of the gene (de Vries, Boveri, Johannsen, Correns, Bateson, Morgan, Delbrück, Muller), cytoplasmic inheritance (Boveri, Morgan, Correns, Winkler, Wettstein, Michaelis, Knapp), plastid inheritance (Correns, Baur, Morgan, Renner, Imai), et alia (Meves, Haacke). The second part of the section covers ideas of Phylogenetics (Johannsen, de Vries, Correns, Timofeeff-Ressovsky, Goldschmidt, Roux, Lotsy, Dobzhansky). The final part concerns Phenogenetics, or gene action (Haecker, Hagedoorn, Grégoire, Klebs, Schleip, Roux, Driesch, Goldschmidt, Bünning). The development of the modern concepts of biochemical genetics is conspicuously lacking.

Geneticists will undoubtedly find many unfamiliar names in this list, and meet many interesting and unknown developments of thought in perusing the volume. If taken for what it contains rather than for what it lacks, this is a volume of first-rate importance. It points the way to a type of scientific orientation all too frequently lacking among our present-day workers. It makes easier the work of the synthesizer who will some day, we may hope, produce a more definitive work.

BENTLEY GLASS

EVOLUTION. *Die Geschichte ihrer Probleme und Erkenntnisse. Orbis Academicus.* *By Walter Zimmermann. Verlag Karl Alber, Freiburg and München.* DM 32.–. x + 623 pp. + 8 pl.; text ill. 1953.

Like the volume reviewed just above, this one undertakes to trace the history of an idea, the concept of organic evolution, through the centuries of growth of

the biological sciences. Following an Introduction that deals with general concepts, there come three main parts. The first, of approximately 100 pages, is concerned with the earliest evolutionary ideas, from the times of mythological interpretations of the world's beginnings to the dawn of scientific philosophies among the Greeks, and the mixed tradition and scholasticism of the Middle Ages. By commentary (in small type) and direct translation from originals (in larger type) a well-knit survey moves forward, with emphasis, naturally, on Aristotle and Theophrastus, Empedokles, Demokritus, and Lucretius. I miss Xenophanes.

Part Two (228 pages) carries the theme through the Renaissance and to the end of the eighteenth century. Although one may be grateful for the wealth of material which the author has included in this section, it remains probably the least satisfactory. Other workers have tilled this soil fruitfully, and Zimmermann takes too little account of their findings. The admirable essays of A. O. Lovejoy on the eighteenth century evolutionists, written early in this century, should form a basis for all writers who would reinvestigate the development of evolutionary ideas; and the outstanding volume of E. Guyenot, *Les Sciences de la Vie aux XVII^e et XVIII^e Siècles: L'Idée d'Évolution*, has likewise been overlooked, so that notable figures such as Maupertuis and Adamson do not figure at all in the present work, in spite of its great size.

Part Three (220 pages) covers the pre-Darwinian portion of the nineteenth century, Darwin himself, and the post-Darwinian era. There is much of interest in the first of these portions, and the coverage of Darwin's own ideas, though brief, is an appropriate selection. The final part, however, is very disappointing. Instead of continuing the method of presenting original thoughts selected to demonstrate the trends of thinking, with a connecting commentary, the author takes over entirely. In spite of his eminence as a student of plant evolution, he provides no clear and comprehensive treatment of the development of ideas during modern times. For this one will have to turn elsewhere—to the works of J. Huxley, Dobzhansky, Simpson, or Rensch, for example. Can one really reduce the importance of de Vries in the development of the mutation theory of evolution to a footnote? Can one ignore almost completely the development of ideas by Morgan and his students? Has population genetics contributed little or nothing to our concepts of evolution? Must Wright, Fisher, and Haldane be relegated to footnotes or the bibliography?

If, in spite of such deficiencies, one examines this book for what is in it rather than what is not in it, then, as in the case of the *Vererbungswissenschaft* in this same series, the reader and student may well be grateful for this rather Germanic view of evolution theory. In comparison, however, Barthelmess has produced a more balanced and more comprehensive survey of the history of a biological idea.

BENTLEY GLASS

THE DARWIN READER.

Edited by Marston Bates and Philip S. Humphrey. Charles Scribner's Sons, New York. $6.75. ix + 470 pp. + 1 pl.; text ill. 1956.

This is no "reader's digest," but a substantial 455 pages of selections, mostly complete chapters, from Darwin's principal works—his *Autobiography, Voyage of the Beagle, Origin of Species, Descent of Man, Expression of Emotion, Climbing Plants, Insectivorous Plants,* and *Formation of Vegetable Mold through the Action of Worms.* Hardly anyone would object to the selections made, and most would accept this collection with pleasure. Each chapter is prefaced by brief but worthwhile editorial notes on the history and context of the selection. A short appendix lists the Darwinian literature, gives a short biography, and makes brief statements on Darwinian influence and on contemporary evolutionary theory.

I believe every biologist should read (and actually, many have not), at least the *Voyage of the Beagle* and *The Origin of Species*; they are an essential part of the cultural background of biology. Furthermore, they are not creations to be read only by aged professors, reflecting upon a lifetime spent in the life sciences, and in what graduate students refer to as the "philosophical (or decadent) stage of life." The *Voyage of the Beagle*, for example, can be read with excitement by any young person interested in natural history, and certainly by undergraduates in biology. I cannot say the same for all of Darwin's works. *The Variation of Plants and Animals under Domestication*, for example, is in toto quite laborious, at least to me. But even this, and others of Darwin's works, have parts that are just as interesting and just as charming as the *Voyage*. They all deserve to be read, if not completely, at least to the extent given in *The Darwin Reader*. I read all of this collection with pleasure.

It was delightful to find such a selection from Darwin's works, and many biologists will be as pleased as I. Teachers, in particular, should enjoy and welcome it. I envy them the pleasure of discussing this book with promising and interested young students who have been directed to it. Many biologists will want to own this book themselves, and certainly it should be in every biology library.

ALAN D. CONGER

THE MARGARET SANGER STORY *and the Fight for Birth Control.*

By Lawrence Lader. Doubleday & Company, Garden City. $4.00. 352 pp. 1955.

The Margaret Sanger story is more than the life-story of a great woman—it is also the story of the birth control movement in the United States. The story begins with an account of the life of Michael Hennesay Higgins, his wife and 11 children, of whom Margaret was the sixth. Higgins was a stonecutter who made marble angels for the local Catholic cemetery. He was also an intellectual rebel in politics, economics, and religion. Freedom of thought and speech was not popular in the Catholic town of Corning, New York; and Higgins was soon subjected to economic boycott by the local priest. Margaret Higgins thus began her life in poverty, a victim of the arrogant intolerance of a Catholic community; but she was exposed to the intellectual stimulation of her unorthodox father and his friends.

With the aid of her older sisters, Margaret was able to go to college and later to become a nurse. It was while serving in a New York hospital that she became interested in birth control. She was shocked by the large families among the poor and by the tragic consequences of their desperate attempts to terminate pregnancies by primitive abortion. During this time she also met Mr. Sanger, whom she married after a brief courtship. Although an architect, he aided his wife's crusade for many years. In 1913 the Sangers went to France to learn more about the contraceptive techniques so effectively used in that country.

On her return to New York, Margaret Sanger began to publicize a birth control program in the *Woman Rebel* and later in a pamphlet, *Family Limitation*, of which ten million copies were printed during the next few years. This pamphlet led to indictments for violating the Comstock law, and although at first acquitted, later indictments led to jail terms. Eventually the law was modified, and now only Massachusetts and Connecticut have laws restricting birth control.

The first conflict with the Catholic Church came when the New York police, acting under orders from the Archbishop, prohibited a birth control talk in the Town Hall. For the rest of her life, Margaret Sanger continued to fight "this official impertinence, this bullying, this arrogant dictatorship, this insolence" of Roman Catholics, though attempts were made to silence her in many cities of the United States and even in U. S.-occupied Japan in 1950. In this fight she had the support of eminent business leaders, newspaper editors, clergymen, and many women who were active in public affairs. In 1922 Mrs. Sanger was invited to Japan and China and later to India. She found that the people of Asia were much more rational in regard to sex and reproduction than the people of the Western world and wrote that "decency and consideration were shown to me instead of bigotry, abuse and hypocracy."

Mrs. Sanger spent so much time on her crusade that she and her husband separated after eleven years of marriage, although she kept in close touch with her two surviving children. Later she met and married Mr. Slee, a wealthy business man. She traveled widely and had the active support of scientists and social workers throughout the world. She now lives in Tucson, Arizona, where she is still active in national and international planned parenthood organizations.

This is a well-written book. It ought to be read by all intellectual rebels who resent dictatorship by church or state. As H. G. Wells observed many years ago, "When the history of our civilization is written, it will be a biological history and Margaret Sanger will be its heroine."

KARL SAX

BIOGRAPHICAL MEMOIRS, VOLUME XXIX.

National Academy of Sciences of the United States of America; 12 contributors. Columbia University Press, New York. $5.00. vi + 359 pp. + 12 pl. 1956.

The *Biographical Memoirs of the National Academy of Sciences* appear now in a new format. The first 28 volumes were published in Washington by the U. S. Government Printing Office. The Columbia University Press of New York has now taken over this task.

Volume XXIX of this series contains 12 biographical sketches with portraits of recently deceased members of the Academy. These are: Charles Elmer Allen, botanist; George Francis Atkinson, botanist; Douglas Houghton Campbell, botanist; Raymond Dodge, psychologist; Dennis Robert Hoagland, plant physiologist; Herbert Eugene Ives, physicist; Arthur Keith, geologist; Arthur Becket Lamb, chemist; Joseph Hanes Moore, astronomer; Joseph Fels Ritt, mathematician; Carl Emil Seashore, psychologist; Frederick Eugene Wright, geologist.

MORRIS C. LEIKIND

THE YOUNG NATURALIST

BOY'S BOOK OF FROGS, TOADS, AND SALAMANDERS.

By Percy A. Morris. The Ronald Press Company, New York. $4.00. 240 pp.; ill. 1957.

This book should appeal to budding young herpetologists of the upper elementary grades. Of course, most protoherpetologists of that age in life are primarily interested in snakes and usually think of amphibians only as food for their pets. Those with more catholic tastes, however, will find this a well-written book with much interesting information. A very simple chapter on phases of amphibian biology is followed by one on collecting and preserving. The bulk of the book consists, thereafter, of a species-by-species account of the amphibians of the United States. Each account contains aids to identification (color, size, etc.), life history

data, geographic range, ecological niche, and usually a photograph or two. Occasionally an interesting historical item or other bit of miscellaneous information is incorporated to provide a welcome change of pace. The photographs are new and refreshing. Yet though many of them are successful, a few do not equal pictures already available.

The book is somewhat marred by a series of minor errors that will probably be easily corrected in the subsequent education of the juvenile reader. For example, creatures with soft unsegmented bodies are equated with mollusks, without any indication that this designation is applicable to other forms; chubby toads are described as hopping contentedly about the yard; "specie" is used as the singular for species in one place; an old name is used for one of the salamanders; some of the geographic ranges and habitat descriptions do not agree with my personal observations; a couple of the photographs are labeled with names not used in the adjacent text; and it is stated that biological supply houses inject the nervous system of certain kinds of frogs with colored liquids.

Several worthwhile opportunities have been missed. There is no discussion of the unique nasolabial groove in the lungless salamanders, nor of the recent genetic work identifying the nature of the mutant strains of the leopard frog in Minnesota. More serious omissions, however, are the lack of identification keys and of a bibliography. Both would have been very useful to the youngsters for whom this book is intended.

The selection of forms to be covered has been handled well. Given the same challenge to restrict the number of species to the space available, I would have agreed with 99% of Morris' choices. This is a successful book that should provide many juvenile naturalists with many pleasant and educational hours. For the interested youngster, it should be an exciting stimulant.

ARNOLD B. GROBMAN

ECOLOGY AND NATURAL HISTORY

PLANT ECOLOGY. *Reviews of Research.* [*Écologie Végétale. Compte rendu de recherches.*]
UNESCO, New York. $7.00 (paper). 376 pp. + 8 pl. + 5 maps.; text ill. 1955.

PLANT ECOLOGY. *Proceedings of the Montpellier Symposium.* [*Écologie Végétale. Actes du colloque de Montpellier.*]
UNESCO, New York. $3.00 (paper). 124 pp. + 8 pl.; text ill.

In its effort to raise the standard of living in regions of marginal agriculture, UNESCO has taken an active interest in the arid and semi-arid lands of the world to consider what might be done with them in order to make them more productive. It was first necessary, however, to know something about the ecology of these lands, and the first volume mentioned above constitutes a comprehensive review of current research activity. With these reports in hand for background and reference material, UNESCO then organized a symposium on the same subject at the University of Montpellier, France, in 1953, and the second volume includes the papers presented at this meeting. The two volumes, therefore, have attempted to bring arid zone ecology to the forefront, and with this knowledge fresh in mind, to foster and stimulate research which would lead to new findings and bring new hope to the peoples existing at marginal levels of food supply.

DENDROCLIMATIC CHANGES IN SEMIARID AMERICA. *By Edmund Schulman. University of Arizona Press, Tucson.* $3.00 (paper). 142 pp. + 2 pl.; text ill. 1956.

On the basis of the author's conclusion that a fundamental advance in the field of dendroclimatology might well depend upon the collection of more reliable and extensive tree-ring data, special efforts were undertaken to obtain such information during the period 1939–1953. Attention was directed primarily to dwarf trees of coniferous species growing in the lower-border zone of Western forests. Such trees, stunted in their growth by a semi-arid environment, were found not only to exhibit great sensitivity to seasonal moisture supply, but frequently to live for centuries beyond the normal life span of their species. This book reports the chronologies derived from the tree-ring analysis of numerous such trees representing essentially all of the drainage basins of the Western United States and Southwest Canada.

Of special biological interest is the report of the discovery of a new source of dendroclimatic history: dwarf bristlecone and limber pines at high elevations in mountain ranges in and near the Great Basin. Selected trees of these species were found to contain highly rainfall-sensitive records several times as long as the oldest of the lower-border zone dwarfs. Three of the bristlecone trees sampled were determined to be in the 4,000-year age class, which makes them substantially older than the oldest dated tree (3,200 years) of *Sequoia gigantea*, the species long recognized as including the oldest living things.

The report is exceedingly well organized, lucidly written, and abundantly documented with numerous tables and graphs. It can surely be read with interest and profit by all biologists.

SCOTT S. PAULEY

THE UNIVERSITY OF CALIFORNIA BOTANICAL GARDEN EXPEDITIONS TO THE ANDES (*1935-1952*), *with*

Observations on the Phytogeography of Peru. Univ. Calif. Publ. Bot., Vol. 28, No. 3.

By T. H. Goodspeed and H. E. Stork. University of California Press, Berkeley and Los Angeles. $1.25 (paper). Pp. 79–142 + 6 pl.; text ill. 1955.

A detailed historical statement of the five University of California Botanical Garden Expeditions to the Andes is followed by a 17-page tabulation of serial collection numbers, with the various collectors' names and pertinent dates and localities. Observations on the phytogeography of Peru include environmental data, descriptions of the vegetation, and lists of collections made by members of the expeditions for the usually dry, but sometimes fog-conditioned, Atocongo lomas, the Ceja de la Montana on the eastern slope of the Andes, the south-central Andean area between Huancavelica and Cuzco and the Mantaro Valley, and the Moyobamba-Tarapoto area of Peru. A bibliography of 19 items is followed by 6 good and instructive photographs of vegetation. The publication should prove useful to phytogeographers in general, as well as to students of the Peruvian flora in particular.

A. J. SHARP

THE SOILS OF THE GLASTONBURY DISTRICT OF SOMERSET (*Sheet 296*). *Mem. Soil Surv. Gr. Br. Eng. and Wales. Minist. Agric. Fish.*

By B. W. Avery. Her Majesty's Stationery Office, London; [British Information Services, New York]. 15s. (paper). iv + 131 pp. + 4 pl. + 1 folded map; text ill. 1955.

This pamphlet is one of a series of soil surveys carried out in Great Britain, and covers in particular the teart pastures which are based on calcareous soils having a high molybdenum content. The geological origin of the soils, and the types of agriculture practiced, are described in some detail.

ISLAND BIBLIOGRAPHIES. *Micronesian Botany. Land Environment and Ecology of Coral Atolls. Vegetation of Tropical Pacific Islands. Publ. 335.*

By Marie-Hélène Sachet and F. Raymond Fosberg; compiled under the auspices of the Pacific Science Board. National Academy of Sciences—National Research Council, Washington. $6.00 (paper). xiv + 577 pp. 1955.

The Pacific Science Board is responsible for this compendium, which should be of enormous aid to those who are concerned with botanical or ecological research in the islands of the Pacific Ocean. The annotated bibliographies are grouped into three divisions, each with an addendum: Micronesian botany; land ecology and environment of coral atolls; and vegetation of the tropical Pacific islands. The main series of published papers covers the period up to November 1, 1954, while the addenda include others compiled up to the date of publication.

SOIL ZOOLOGY. *Proceedings of the University of Nottingham, Second Easter School in Agricultural Science, 1955.*

Edited by D. Keith McE. Kevan. Academic Press, New York; Butterworths Scientific Publications, London. $10.00. xiv + 512 pp. + 16 pl.; text ill. 1955.

This book is surely a necessity for all concerned with the scientific study of the soil. It is not a systematic treatise on soil zoology; but it presents a diverse, stimulating, and first-hand account of selected problems, methods, and results in this important area of investigation.

The first part of this solid fact-filled volume of over 500 pages comprises some 25 papers complete with individual bibliographies. Happily, each begins with an informative abstract. The topics range from studies of the effects of agricultural practices on soil fauna and of the influence of the fauna on the soil, to accounts of the ecology of various types of forest soils and populational studies of such organisms as mites and collembola. Understandably, the earthworms and nematodes receive a major share of attention. One is impressed by the mass of data accumulated since Darwin published his work on earthworms and the soil over 70 years ago, but one is equally aware of the gaps that still exist in our knowledge. The amount of earth carried to the surface annually by earthworms under different climatic and pedological conditions has been very accurately determined, but whether mull soils are mulls, and mors are mors, primarily because mulls are rich in earthworms, which mors lack, or whether the abundance and scarcity of lumbricids is dependent on the type of soil, is still uncertain. Much attention is devoted in the volume to population studies and to quantification generally.

The second part of the book contains about 25 papers on methods, evidently written from first-hand experience. This may well prove to be the most useful section of the book, especially since many of the pieces of equipment discussed are carefully described with scaled line drawings and plans intended to facilitate the construction of the apparatus by the reader. Here again, nematodes and earthworms are emphasized; but methods dealing with soil arthropods, protozoans, and other animals are included. A final 37-page appendix is devoted to a "practical key" to the orders and suborders of "soil and litter inhabiting" animals. Unfortunately this key must be viewed with regret. In some places it is too general to be of any real value, and in others it is

worse than useless because of errors of fact. What user of a book like this would conceivably need a key to tell the difference between a mole and an earthworm? On the other hand, moles are easily confused with shrews and with voles, both of which are frequently found in litter and even under the soil; but neither is so much as mentioned. The key to nematodes is worthless because the phasmids, on which the major division of nematodes is based, are neither described nor pictured beyond the bare statement that they are minute and difficult to see. Worse yet, they are said to be "post oral" when actually they are located close to the tail tip. Perhaps phasmids have been confused with amphids, which are indeed located post-orally. In any case, the true situation is explained and some really practical advice on nematodes is given earlier in the book (p. 50). Under annelids, Prosopora is used where Plesiopora is evidently meant. Flatworms and rotifers are grouped together as scolecids. The section on insects emphasizes larval forms and appears to be better. It is the longest section and is well illustrated.

Most of the contributors are English or Scandinavian, though other regions are represented. The book is well indexed.

GAIRDNER B. MOMENT

PLYMOUTH MARINE FAUNA. *Third Edition.*

Marine Biological Association of the United Kingdom, Plymouth. 32s. (paper). xliii + 457 pp. + 1 folding map; text ill. 1957.

Following an introductory part describing the features and locations of the main collecting grounds, the species known to occur in the Plymouth region are listed by taxonomic categories, with notes on habitat. The number of species listed is large, and the list should be helpful to those working at the Plymouth Laboratory, as well as to those at other stations who wish to make comparisons. The handbook terminates with a considerable bibliography and an index of generic names.

L. H. HYMAN

DISTRIBUTION AND ECOLOGY OF THE MARINE INVERTEBRATES OF POINT BARROW, ALASKA. *Smithson. misc. Coll., Vol. 128, No. 9.*

By G. E. MacGinitie. Smithsonian Institution, Washington. $2.25 (paper). 201 pp. + 8 pl.; text ill. 1955.

A knowledge of arctic faunas is usually the product of collecting expeditions, but this contribution is unique in being based upon a first-hand study by a resident naturalist at an arctic station. It is therefore an especially valuable addition to knowledge of invertebrate arctic life. The earlier sections of the work deal with the facilities of the station and with the physical and chemical properties of the environment. The remainder and major part concerns the invertebrate life. Methods of collection and preservation, and data of the stations, are given in detail. An interesting discussion is given on reproductive phenomena, including a table on breeding with relation to season. A large part of the work takes up the fauna by phyla, and includes a variety of interesting notes on habits, food, reproduction, and the like. From the description, the marine animal life at Point Barrow is astonishingly abundant as to numbers of individuals.

L. H. HYMAN

RICERCHE SULLA MICROFAUNA DELLE ACQUE INTERNE FERRARESI. *Introduzione allo studio dei Ciliati e dei Rotiferi. Publicazioni del Civico Museo di Storia Naturale di Ferrara, IV.*

By Mario F. Canella. Civico Museo di Storia Naturale di Ferrara, Ferrara, Italy. viii + 154 pp. + 45 pl.; 1954.

This thoughtful introduction to an ecological study of the microfauna of the freshwaters of Ferrara, especially the ciliates and rotifers, is embellished with 45 excellent photographic plates. Unfortunately for freshwater biologists and other invertebrate zoologists or ecologists whose knowledge of the Italian language is scanty, no summary in any other language has been provided. (Needless to say, the author's own knowledge of the chief foreign languages of science is extensive.)

THE REEFS OF TAPROBANE. *Underwater Adventures Around Ceylon.*

By Arthur C. Clarke; photography by Mike Wilson. Harper & Brothers, New York. $5.00. xii + 205 pp. + 30 pl. 1956.

Afficionados of the aqualung will probably consider this book a necessity. I found it interesting, but esoteric. The plot is straightforward enough—a series of diving adventures accompanied by the observations of a two-man expedition to Ceylon (anciently called Taprobane) and accounts of their associations with other divers there. Experienced Ceylonese divers who accompanied the author and his party displayed an amazing disregard for the hazard of sharks. They even swam in shark-infested waters with speared game fish festooned on a belt around their waists. It is, in fact, proposed here that sharks are actually no hazard to the diver! Having just previously read the article, Sharks versus Men, by George A. Llano, in the June, 1957, *Scientific*

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ALAN D. CONGER

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ROMEO MANSUETI

TREASURY OF SNAKE LORE. *Edited by Brandt Aymar. Greenberg Publishers, New York.* $5.00. xv + 400 pp. 1956.

I probably exhibit the reaction of the average person to the sight of a snake. Coming suddenly upon even the garden variety, I invariably break out in a cold sweat. I dare not walk a woodland path without careful and constant scrutiny. From the security of a livingroom chair, however, I can find real enjoyment in this volume of snake lore, for it contains every important reference to herpetology, from books of worship, mythology, and fable through collections of essays, short stories, poetry, and tales of adventure. It is a wonderful compendium and reflects enormous credit on the erudition, breadth of knowledge, and selectivity of the editor. And, as Aymar points out in his Preface, "the snake is not all venom and vice." The reader can take what comfort he needs from this.

C. P. SWANSON

THE RACCOON IN KANSAS, NATURAL HISTORY, MANAGEMENT, AND ECONOMIC IMPORTANCE. *Misc. Publ. Mus. nat. Hist. Univ. Kans., and State Biol. Surv. Kans., No. 10.* *By Howard J. Stains. University of Kansas, Lawrence.* Free upon request (paper). Pp. 1–76 + 4 pl.; text ill. 1956.

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Students of these animals in other regions will find some of the study techniques used here to be worthy of emulation. For example, raked areas along stream borders were used to detect and time raccoon activity. Tracks across raked areas indicated recent movements, direction of travel, and, in some cases, numbers. Game managers will find this book a useful reference work, although much of it seems to be documentation of facts that are already well known.

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LE LIVRE DES SANCTUAIRES DE LA NATURE.

By Louis Robin. Editions Payot, Paris. 900 fr. (paper). 262 pp. + 16 pl. 1954.

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GROWTH, POPULATION DYNAMICS, AND FIELD BEHAVIOR IN THE SPINY LOBSTER, *PANULIRUS INTERRUPTUS* (RANDALL). *Univ. Calif. Publ. Zool., Vol. 59, No. 6.*

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EVOLUTION

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Standards and units are as important in biology as they are in physics or chemistry. Yet, for many reasons, they are usually much more difficult to define. There are always borderline cases, whether we deal with the cell or the individual, the age level of adulthood, sexuality, or whatever phenomenon we want to select in any branch of biology. The need for precision and the tantalizing inability to achieve it constitute perhaps the main reason for the never-ending fascination of the "species problem." The species is the principal unit in the classification of organisms, and every working systematist must make up his mind what to consider a species. This is a problem which is difficult enough for the student of living faunas and floras, but even worse for the student of fossils. Indeed, some paleontologists have given up in despair and frankly sort individual fossil specimens into artificial aggregates purely on the basis of morphological similarity. Others try valiantly to apply the findings of modern population genetics, in the hope that this might help to clarify the situation.

The Systematics Association in England held a special symposium on The Species Concept in Paleontology "for the purpose of promoting exchange of views between zoologists and paleontologists on the application of the more recently developed taxonomic methods to paleontological problems." The 17 contributed papers of the symposium volume represent extremes of viewpoint, as well as the majority opinions. Deliberately oversimplifying the situation, one may say that paleontologists belong to either one or the other of two schools: those who consider fossils as the remains of formerly living organisms, and who by analysis of samples of fossil specimens attempt to reconstruct the appearance of the formerly existing natural populations; and those who simply try to classify the diversity of fossil specimens into groups of morphologically similar specimens, designating them arbitrarily as species. "The only logical criterion for the size and definition of the taxon in paleontology is its usefulness," says Arkell, without stating clearly which of the innumerable ways of defining "usefulness" he adopts. This approach frequently results in the splitting of a single polymorphic population into several species, and has led to a protest: "The paleontologist who classes members of a single interbreeding community in more than one species is liable to confuse even himself. . . . The distinction, in fact, between morphological species and biospecies can be overlooked only at the peril of utter confusion" (Sylvester-Bradley). All speakers agree that the task of the paleontologist is extremely taxing. Theoretically at least he should not encounter species at all, but merely lineages of gradually changing populations. It is only by the accident of the highly incomplete fossil record that nearly all such lineages are conveniently broken into classifiable species. One other difficulty is that all

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taxonomic decisions are based on inferences from a study of specimens, as are of course also nearly all decisions of the neontologist. Yet it is precisely in drawing these inferences, as was pointed out by Simpson long ago (1943, *Ann. N. Y. Acad. Sci.*), that the information of population genetics and new systematics becomes so vital. The questions, how far this application can be carried, whether the demands of the stratigrapher are in conflict with the aims of the biologist, and how to differentiate between habitat "forms" and chronological races or species, indicate some of the topics discussed by the speakers. The symposium as a whole reflects a critical stage in the development of paleontology. It will be interesting to watch whether the "new paleontology" which is developing after a period of extreme "splitting" in many branches of invertebrate paleontology will bring the same simplification that the new systematics has brought to the classification of many groups of recent animals.

E. MAYR

LEHRBUCH DER PALÄOBOTANIK.

By Walther Gothan and Hermann Weyland. Akademie Verlag, Berlin. DM 46.–. 536 pp.; ill. 1954.

This book deals with all aspects of paleobotany in a comprehensive and integrated fashion. The treatment is essentially phylogenetic, beginning with the earliest algal and fungal remains and concluding with the dicotyledonous Sympetalae. A final chapter considers the character and distribution of early floras by geological period, the ecology and climate associated with each major floral outburst, and problems relating to phylogeny and morphogenesis. The text is bolstered by more than 400 well-chosen and well-executed illustrations.

PLIOCÉNSKA FLORA OKOLIC CZORSZTYNA I JEJ STOSUNEK DO PLEJSTOCENU (*Pliocene Flora from the Vicinity of Czorsztyn and its Relation to the Pleistocene*). *Prace. Inst. Geol., Tom XI.*

By Władysław Szafer. Polska Adakemia Nauk, Warsaw. 238 pp. + 1 folded table + 1 folded chart + 20 pl. 1954.

In Polish, with summaries in Russian and English, this publication reports a flora of 205 species from a new Pliocene locality. By means of many tables the author analyzes the composition of the flora so that comparisons can be drawn with other European Pliocene floras and with those of the succeeding Pleistocene epoch. The paper is a continuation of Szafer's diligent studies of Pliocene and Pleistocene floral problems in which, as before, he had the benefit of the identifications and conclusions embodied in the brilliant contribution, *The Pliocene Floras of the Dutch-Prussian Border*, by Clement and Eleanor Reid in 1915.

The materials of the large collection here described comprise pollens, spores, and carbonized remains, chiefly of seeds and fruits, taken from strata at Mizerna along a tributary of the Dunajec River about 3 km. northwest of Czorsztyn, near the west end of the Carpathian Mountains in the province of Krakow, Poland. To judge from the 20 plates of fine illustrations, the fossils are unusually well preserved and permit satisfactory determinations. They include fungi, mosses, ferns, conifers, monocotyledons, and dicotyledons distributed through 7 stratigraphic zones.

From the bottom to the top of the sequence of strata Szafer keeps a critical eye on the changes in percentage of species he regards as common to or closely allied with the present European and Holarctic floras and those of extra-European affinity. Thus, he finds that in the bottom zone the extra-European species predominate and to him indicate a relatively warm climate comparable to that for his previously described Lower Pliocene flora from Kroscienko. In the next zone the European and Holarctic species increase notably, indicating a turn to cooler conditions. In the third zone the exotic species again become dominant in a warm spell. The fourth zone records a sharp increase in the European and Holarctic species, and to Szafer this strong reversal toward cold, which is continued in the remaining zones, is so impressive that he designates the base of the zone as the boundary between the Pliocene and Pleistocene. Should this conclusion be confirmed at other localities it may be the solution to the perplexing Pliocene-Pleistocene boundary problem, at least for Europe to the north of the transverse mountains which, being formidable barriers that prevented much plant migration southward and their return during the Pleistocene glaciation, were the indirect cause for the extinction there of many species and the relative impoverishment of the present flora.

ROLAND W. BROWN

ORDOVICAN TRILOBITES OF ARGENTINA.

By Horacio J. Harrington and Armando F. Leanza. University of Kansas Press, Lawrence. $6.00. 276 pp.; ill. 1957.

For the past twenty years, the authors of this volume have been bringing contributions to the Ordovician faunas of Argentina. In recent, extensive explorations of the northwestern portion of that country, a great wealth of new Ordovician fossil material has been brought to light. The first part of the monograph (by the senior author) describes the Ordovician formations of Argentina and their correlation with European and North American deposits. The second part includes the

systematic descriptions of 26 new trilobite genera and 124 species, of which 70 are new. The trilobites are assigned to a succession of faunizones, beginning with the lower Tremadocian and extending to the Caradocian (the European standard time scale is used as the most appropriate to describe the faunal succession).

Besides the exceptional interest inherent in a comprehensive description of large faunas previously known only from fragmentary contributions, several other features make this monograph unusually attractive and easy to read. The authors must first be complimented on the excellence of their systematic descriptions and especially the illustrations, both the photographic reproductions and the restorations. A welcome novelty in publications of this type is the printing of text, line drawings, and photogravure reproductions on the same paper, and with gratifying results. This procedure allows all the illustrations of a species to be placed next to its description in the text, where they can be conveniently inspected while reading the description, instead of having to turn to special plates relegated to the end of the volume. This and other typographic features are substantially identical with those of the *Treatise on Invertebrate Paleontology*, edited by Raymond C. Moore, who also sponsored the publication of the present volume as the first in the series of the Special Publications of the Department of Geology of the University of Kansas. To all who are familiar with the already published volumes of the *Treatise*, Moore's sponsorship indicates that the book meets the highest standards of quality in illustrations, typographic accuracy, paper, and binding. Other valuable features are numerous maps indicating the position of all fossil localities, paleogeographic maps, a correlation chart of the Ordovician formations of Argentina, and an index of all localities with fossil lists.

A minor fault is the lack of explanation for the classification of trilobites adopted by the authors and summarized on pages 60–63. This classification differs in several respects from the classifications published by previous authors, especially in raising the rank of many taxonomic units. Orders, suborders, and superfamilies are used somewhat too lavishly for my own taste. For this state of affairs, to be sure, all trilobite students are to a greater or lesser degree responsible. We all have sinned in making genera on the most trifling characters; no wonder, then, that but slightly more significant features should be deemed valid for family distinctions, and that, ultimately, one should wind up with "suborders" that are not much better than genera in other animal groups fortunate (or maybe unfortunate) enough to have fallen into the hands of more conservative taxonomists.

Looking at the beautiful illustrations in this volume, one is struck by the large percentage of Argentinian trilobites known from complete exoskeletons, in marked contrast to the fragmentary occurrence of most Lower Ordovician trilobites in North America. Another remarkable feature is the Cambrian aspect of many of the Tremadocian trilobites. This resemblance leads the authors to assign several species of Agnostids to genera based on type species from the Scandinavian Middle Cambrian. So extreme a stratigraphic range is exceptional even for such a conservative group as the Agnostids.

In conclusion, this monograph represents an outstanding contribution to the study of trilobites and of Ordovician faunal distribution and correlation. In the words of Raymond Moore, it "will remain through unnumbered years an indispensable source book, and thus permanence of its place in scientific libraries is assured."

FRANCO RASETTI

TREATISE ON INVERTEBRATE PALEONTOLOGY. *Part P. Arthropoda 2. Chelicerata with sections on Pycnogonida and Palaeoisopus.*

By Leif Størmer, Alexander Petrunkevitch, and Joel W. Hedgpeth; edited by Raymond C. Moore. Geological Society of America, New York; University of Kansas Press, Lawrence. $3.50. xviii + 181 pp.; ill. 1955.

Of the 22 main parts of this projected treatise, this one is the fifth to be issued. Like the others, it represents as definitive a treatment as can be prepared at the present time and is richly and excellently illustrated. The subphylum Chelicerata includes the classes Merostomata and Arachnida. The Pycnogonida is regarded as a separate subphylum of arthropods. The class Merostomata, here reviewed and revised by L. Størmer, includes the Xiphosura or kingcrabs and the Eurypterida. J. Hedgpeth treats the few fossil pycnogonids which are known, and excludes the problematical fossil *Palaeoisopus* from that group, leaving it as an arthropod *incertae sedis*. The major part of the volume is occupied by A. Petrunkevitch's superb treatment of the Arachnida.

SOME EXTINCT ELEPHANTS, THEIR RELATIVES AND THE TWO LIVING SPECIES.

P. P. E. P. Deraniyagala. National Museum, Colombo, Ceylon. (paper). ii + 161 pp. + 48 pl.; text ill. 1955.

Unquestionably one of the most valuable publications on elephants to date, this monograph far exceeds the usual systematic treatise in the scope of the material covered. The review of extinct as well as living species and subspecies includes a remarkable amount of valuable information on the biology and variation of the elephant, and is spiced with anecdotes on elephant

hunting, capturing, and taming, and with the lore of the mahout who knows the effects of pressure on no less than 90 nerve centers which he employs to control the beast. Mating and parturition are described in some detail, including data on the must period; and there are numerous tabulations of measurements of body and tooth dimensions to illustrate the elephant's growth and maxima. Geographic distributions of the present species and subspecies are given, together with available information about that of such extinct forms as the Chinese "subspecies" of *Elephas maximus*, which is known only from historical records and the *type* of which is given as an antique bronze statue now in the Field Museum, Chicago! The plates include not only photographic reproductions of significant material but also many artistic drawings and sketches to illustrate elephant behavior and restorations of extinct species.

THREE MIOCENE PORPOISES FROM THE CALVERT CLIFFS, MARYLAND. *Proc. U. S. Natl. Mus., Vol. 105. No. 3354.*

By Remington Kellogg. Smithsonian Institution, Washington. Free upon request (paper). Pp. 101–154 + 21 pl.; 1955.

SPECIATION OF THE WANDERING SHREW. *Publ. Mus. nat. Hist. Univ. Kans., Vol. 9, No. 1.*

By James S. Findley. University of Kansas, Lawrence. Free upon request (paper). 68 pp.; ill. 1955.

THE FOSSIL EVIDENCE FOR HUMAN EVOLUTION. *An Introduction to the Study of Paleoanthropology. The Scientist's Library.*

By W. E. Le Gros Clark. University of Chicago Press, Chicago. $6.00. x + 181 pp.; ill. 1955.

This little book is a welcome summary of the author's views on human evolution, particularly relating to the fossil evidence; for Sir Wilfred is one of the leading students in this field. The volume consists of 5 chapters: Morphological and Phylogenetic Problems of Taxonomy in Relation to Hominid Evolution; Homo; Pithecanthropus; Australopithecus; and The Origin of the Hominidae.

One may not agree with all of the author's views—as when he labels such "early" Neanderthaloid specimens as the Steinheim, Ehringsdorf, Krapina, and Saccopastore skulls as "Homo sapiens," or in his appraisal of the australopithecines—but he is in general sound, and his ideas are stimulating.

The format of the book is attractive, but its price ($6.00), for so slender a volume, seems somewhat excessive.

THE PILTDOWN FORGERY.

By J. S. Weiner. Geoffrey Cumberlege, Oxford University Press, London, New York, and Toronto. $3.50. xii + 214 pp. + 5 pl. 1955.

The scientific and lay interest which centers around the remains of fossil men probably reached its peak when, in the years preceding the First World War, it was claimed that parts of a fossil human skull had been found in association with an ape-like mandible. Controversy between those who believed that these remains represented a single archaic species and those who felt that the association between the cranium and mandible was fortuitous lasted for more than forty years. It was resolved only some two years ago when J. S. Weiner, K. P. Oakley, and their collaborators showed conclusively by modern physico-chemical techniques that the human Piltdown cranium was from a relatively recent geological deposit and that the jaw was of even younger date. Anatomical reexamination showed that it was, in fact, from an orang-utan, and that certain peculiarities of the teeth had been produced artificially post mortem. The associated fossil mammals which had originally been used to date the remains were proved to have been introduced fraudulently, and it was suggested that the entire collection had been assembled as a hoax.

Official accounts of these recent studies have been published by the British Museum, and Weiner's book, which is directed towards a wider public, forms a postscript to the Piltdown controversy. After a brief recapitulation of the history of the fossils, Weiner summarizes the recent conclusive analyses of their characteristics. Then, in an attempt to establish who, in the first place, perpetrated the hoax, he proceeds to an examination of the circumstances and personalities associated with the Piltdown discoveries. The evidence which Weiner has been able to adduce directs almost overwhelming suspicion toward the amateur archeologist who first described the finding of the remains, but, it is carefully pointed out, the available facts are not quite sufficient to prove his guilt.

The book is presented in a simple scholarly style, and all students of fossil man will be indebted to Weiner for this summary of the Piltdown story. Professional physical anthropologists will be especially grateful for his having drawn attention to the potentialities of the new physico-chemical techniques which featured so prominently in the analysis of these remains.

E. H. ASHTON

THE NON-HUMAN PRIMATES AND HUMAN EVOLUTION. *In Memory of Earnest Albert Hooton 1887–1954.*

Arranged by James A. Gavan. Wayne University Press, Detroit. $3.50. viii + 134 pp. + 1 pl.; text ill. 1955.

The papers in this symposium were first presented in 1953 and were later published in *Human Biology*, before the present volume was published. Professor Hooton, to whom this volume is dedicated, contributed the opening paper shortly before his death. It is fitting that the subject of the symposium is the non-human primates, whose importance in the study of human evolution he had long stressed.

Although the contributors include physical anthropologists, paleontologists, comparative anatomists and psychologists, all of the contributors stress the enormous potential contribution, and, indeed, the indispensability of studies of non-human primates to an understanding of human evolution. Hooton even goes so far as to propose the establishment of "Departments of Primatology" in research institutions and universities. One fact that will certainly strike the reader is the singularly small fund of information available on the non-human primates. As Hooton points out, even their gross anatomy is relatively unknown, their physiology is practically unknown, and their genetics is completely unknown. It is sufficient that the present work contains 3 papers on primate paleontology, 4 on anatomy, and 3 on psychology, plus Hooton's opening paper and the closing remarks by W. L. Straus, Jr. The participants, while providing valuable contributions in their fields, also present an eloquent plea for workers in other fields to join them in their study of the primates.

The present publication of the symposium is marred by the fact that two of the papers are presented only in abstract, although they were both presented in full at the time of the symposium. Unfortunately, they are the only two papers dealing with the New World monkeys, a group which seems, to the reviewer at least, of prime importance.

MICHAEL A. BENDER

GENETICS AND CYTOLOGY

GENETIC MECHANISMS: STRUCTURE AND FUNCTION. *Cold Spring Harb. Symp. quant. Biol., Vol. XXI.* *The Biological Laboratory, Cold Spring Harbor.* $8.00. xviii + 392 pp. + 2 pl.; text ill. 1956.

The early summer of 1956 witnessed two outstanding genetic meetings: the McCollum-Pratt symposium on the Chemical Basis of Heredity; and the Cold Spring Harbor symposium, reviewed here, which was intended to bridge the existing gap between the genetics and the development of organisms. Though there was little duplication of speakers, there was some overlap of subject matter in the two symposia, so that they jointly cover most of the recent developments which have made genetics one of the most exciting areas of modern biology.

In considering the structure and function of genetic mechanisms, the Cold Spring Harbor symposium is divided logically among the several levels of organization at which these problems can be attacked with current techniques. At *the chemical level*, the structure and activity of deoxyribose nucleic acid (DNA) is considered by Kanazir and Errera; by Bendich, Pahl, and Beiser; by Wilkins; and by Hershey and Burgi. Mirsky, Osawa, and Allfrey deal with the nucleus as a site of biological activity; and Caspersson discusses quantitative cytochemical determinations on endonuclear structures. With the exception of Dunn's treatment of a complex gene in the mouse, a gene concerned with tail abnormalities, the section treating *the genic level* is largely occupied with problems of mutation and recombination in microorganisms (phage T2, *Salmonella*, *E. coli*, *Neurospora*, *Aspergillus*, and *Saccharomyces*). It is evident that the search for the gene in all its manifestations goes on apace and that each new finding makes clearer the difficulty of defining the gene, regardless of the framework within which partial definitions are made.

At *the chromosomal level*, McClintock makes a sharp distinction between genes, as such, and "controlling elements" (e.g., the *Ac-Ds* system in maize) which modify gene action without affecting gene structure. Beermann considers the intriguing problem of nuclear differentiation as reflected in the changing morphology of the chromosome during development, while Kaufmann and McDonald discuss the organization of the chromosome as revealed by the latest techniques. Levine, in his paper on chromosome organization and crossing over, makes what seems to be a grave error, or at least a premature assumption, in equating recombination in some of the microorganisms with crossing over, as it is known in the higher forms. It remains to be proved that the same mechanism is at work in both instances.

The action of genes at a *cellular level* is the subject of 7 papers. Helen Gay discusses the nucleocytoplasmic relations in *Drosophila*, as judged from the examination of electron microscope figures of salivary gland cells. King and Briggs, in an extension of their nuclear transplantation studies, show that the serial transfer of endoderm nuclei does not alter the capacity of the transplanted nuclei to induce a particular degree of development or differentiation, and conclude that nuclear capacities change as differentiation proceeds. Caspari and Blomstrand discuss genetic influences on the structure and differentiation of cytoplasmic particles, such as mitochondria and pigment granules. Rudkin and Schultz report their studies of the sacrosomes (giant mitochondria) in 2N and 3N *Drosophila*. While they found no consistent size differences, it is of interest that they could find no ribose nucleic acid in these structures on the basis of absorption techniques, even though all the enzymes of normal mitochondria appear to be present in them. In another paper, Schultz returns to the consideration of heterochromatin and

its role as a sort of feed-back system in nucleic acid metabolism. A good deal of experimental data and a stimulating discussion are provided. Brachet and Chantrenne examine the role of DNA in directing protein synthesis. It is apparent from their discussion that, while the nucleus exerts a control on both extranuclear and intranuclear synthesis, the pathways are by no means clear at the present time. Markert, in an important contribution, deals with the patterns of cell function in development; by examining different tissues having a genetic similarity, he indicates that the acquisition of distinctive metabolic patterns involves both qualitative losses and qualitative gains in synthetic activity, as well as shifts in relative synthetic activity.

Zwilling, Hoecker, Hadorn, and Stern tackle the difficult, but essential problem of genetic influences at the *level of developing organism*. These must ultimately be resolved at biochemical levels of difference; and in all of the instances discussed, it is clear that development and differentiation are the result of a very delicately balanced and integrated system of parts which can be thrown out of kilter at various stages and by various influences.

This symposium, like other genetic symposia from the Cold Spring Harbor annual meetings, will serve as a reference volume for years to come. It not only provides a measure of the sophistication of genetic investigations today, but it also points out the direction of future research. More questions are raised than positive answers can be provided, but a well-framed question is often more important that an immediate answer.

C. P. SWANSON

GENETISCHES UND CYTOGENETISCHES WÖRTERBUCH. *Züchter, 2. Sonderheft.*

By R. Rieger and A. Michaelis. Springer-Verlag, Berlin, Göttingen, and Heidelberg. DM 23.50 (paper). iv + 140 pp.; ill. 1954.

This genetic and cytogenetic dictionary should go far to supply the need for such a reference work, a need frequently expressed both by workers in the field and by those in peripheral fields who need some clue to the technical language in which the geneticist clothes his concepts. Up to date for the time of publication, and critically and carefully compiled from numerous authoritative sources, the publication is a distinct improvement over previous efforts of this kind.

English and German terms follow one another indiscriminately in the alphabetical list, and following each main term there is a collection, often extensive, of subsidiary concepts. Thus, after a concise ¾-column on the term *Chromosom*, there follow 9 additional columns devoted to such subsidiary terms as *Chromosomen, Dizentrische* (with figure); *Chromosomenbruch; Chromosomengrösse; Chromosomenkarten; Chromosomenmutationen; Chromosomenpaarung;* and *Chromosomenzahlenverminderung* (with figure). The dictionary, while retaining conciseness, consequently becomes somewhat more encyclopedic in treatment.

Even the rapidly developing new field of bacterial genetics is represented, by such terms as *Transformation* and *Transduction*, although phage genetics seems not to have been included. Particularly valuable is the discussion of such debatable concepts as *Plasmagene* in terms of the divergent or complementary interpretations of such workers as Darlington, Catcheside, and Michaelis.

An edition of this work in English would be of real value, particularly if at the same time it could be brought up to date. It would also be desirable to have it in the form of a more compact handbook, instead of in its present over-sized 8 x 12", paper-covered format.

BENTLEY GLASS

LIFE HISTORY AND CYTOLOGY OF THE FORAMINIFERAN, *ALLOGROMIA LATICOLLARIS*. *Univ. Calif. Publ. Zool. Vol. 61, No. 4.*

By Zach M. Arnold. University of California Press Berkeley and Los Angeles. $1.25 (paper). iv + pp. 167–252; ill. 1955.

Since *Allogromia* occupies a critical position in taxonomic schemes as a type genus of the family from which other foraminiferan families apparently have been derived, a detailed study of the cytology of the genus has been made. The particular species used is easily cultivated in the laboratory, has a relatively short life span, and is amenable to cytological study. So far as meiotic and mitotic phenomena are concerned, the genus appears to be similar to higher forms of life, even though its nucleolar behavior is somewhat unique. Since its meiosis was first described only in 1950, this study adds significantly to our knowledge of a group that is poorly known cytologically, though very well known and studied paleontologically. Because of its suitable growth and cytological characteristics, it may well be that this is another organism that can be exploited for genetic studies of various kinds.

C. P. SWANSON

CYTOLOGY OF THE BLOOD AND BLOOD FORMING ORGANS. *By Marcel Bessis; translated by Eric Ponder. Grune & Stratton, New York and London.* $22.00. xxxiii + 629 pp. + 22 pl.; text ill. 1956.

This text, by the best-known authority among the European hematologists, is a fine piece of work. It is well organized, clearly written, profusely illustrated,

and up to date. The chapter plan is conventional. Part One describes techniques, Part Two the physiology and pathology of blood cells, and Part Three the different series. Preceding the text are 21 color plates which, though the colors are too bright, should serve to acquaint the reader with the appearance of preparations stained by the various techniques. The remainder of the illustrations (405 figures and 1 plate) are in black and white and of uniformly high quality. They include a large number of electron micrographs, both of shadowed and sectioned preparations. Each chapter ends with a copious list of references. The text does not seem to have suffered at all from translation. The volume should serve the general biologist, as well as the hematologist, as an excellent reference book.

F. N. Low

HERITABLE DISORDERS OF CONNECTIVE TISSUE.

By Victor A. McKusick. The C. V. Mosby Company, St. Louis. $7.50. 224 pp. + 1 pl.; text ill. 1956.

The main part of this book describes five different syndromes involving inherited disorders of the connective tissue. Introductory chapters describe the clinical behavior of these syndromes and the biology of normal connective tissue. A concluding chapter describes other possibly heritable connective tissue diseases of lesser importance. The illustrations, for the most part, are photographs of the clinical conditions discussed. Each chapter ends with an extensive bibliography. For the medical geneticist and specialist, this monograph is of good quality; but its usefulness outside its special field is very limited.

F. N. Low

THE EFFECT OF EXPOSURE TO THE ATOMIC BOMBS ON PREGNANCY TERMINATION IN HIROSHIMA AND NAGASAKI. *Nat. Acad. Sci., Publ. No. 461.*

By J. V. Neel and W. J. Schull; 13 collaborators. National Academy of Sciences, Washington. $2.00. xvi + 241 pp.; ill. 1956.

In the most ambitious survey of its kind ever undertaken, the Atomic Bomb Casualty Commission investigated the outcome of 76,626 pregnancies terminated in Hiroshima and Nagasaki between 1948 and 1953. The primary aim was to determine if genetic damage to infants born of parents who had been irradiated during the atomic bombings of these cities was revealed (1) by sex ratios of infants, (2) by occurrence of major malformations, (3) by viability at birth, (4) by birth-weight, or (5) by death during the first 6 postpartum days. A suitable control series of infants born of parents not exposed to irradiation was also examined. Post-war conditions in Japan delayed the survey for 2 years after the bombing, and important data were thus unavoidably lost. But the project was well organized, with full cooperation from Japanese as well as American personnel. Great care was taken to obtain as random a sample as possible, pregnant mothers being invited to give certain information for further investigation while they were obtaining tickets for food and other rationed items. The methods of collecting, classifying, and coding data will be useful to future infant population studies of whatsoever nature.

In evaluating the data statistically, the authors have described their methods in considerable detail and have often used several methods in approaching a single problem. The effects of various concomitant variables, such as maternal age and order of birth of infant, known to affect various traits, have been assessed, and the resulting biases removed, where necessary.

No conspicuous genetic effects of the atomic bombings were demonstrated by this thorough investigation. None of the 5 indicators gave a consistently positive suggestion of genetic damage. The authors feel that some mutations were undoubtedly caused by the atomic irradiation, but these were not revealed by the methods of the survey or by the indicators used. This work should be a strong stimulus for future mutation-frequency research in lower mammals, since, with the exception of Russell's work on radiation-induced mutations at certain loci in mice and of studies of spontaneous mutations at specific loci in man, there is a sad lack of information on which to base estimates of radiation hazards in human populations. Though one hopes that no future studies of this kind will be necessitated by acts of war, the present pioneer survey may nevertheless serve as a model for future studies of human populations subjected to the increased radiation resulting from the industrial use of atomic energy. Man is becoming increasingly concerned with the possible genetic consequences of the atomic age.

SARAH B. PIPKIN

GENETICS LABORATORY EXERCISES.

By Eldon J. Gardner. Burgess Publishing Company, Minneapolis. $2.50 (paper). xiv + 47 pp.; ill. 1956.

This spiral-bound manual would seem to be an entirely satisfactory guide for laboratory exercises designed to supplement a lecture course in general genetics. Most of the experiments are either demonstrations or confirmations of known principles. There is, however, enough of the unknown and unpredictable in some to make them useful in teaching the experimental method.

VICTOR A. MCKUSICK

SEX AND THE NATURE OF THINGS.

By N. J. Berrill; with drawings by the author. Pocket Books, New York. 35 cents (paper). xvi + 222 pp.; ill. 1955.

A very poorly bound paperback reprint of a book first published in 1953. The pages come loose at the least touch, but the thoughts cling together nicely. The author's style is altogether admirable, being clear, vigorous, and full of color. Who could forget the imagery of "a massive turbulent maelstrom of spawning eels" or the whimsical suggestion of the sentence: "If mammalian males have suffered tribulation in the interests of paternity, so have females for the sake of maternity"? The book is a true masterpiece of popular science, well worthy to take its place beside *The Sea Around Us* among the classics of this generation. It is also a sufficient answer to the question: Is sex necessary?

The final paragraph of the book is especially worth quoting:

> Yet out of sex cells came evolution; from sex hormones came the sexes and a certain mutual bondage; from milk came maternity and the concern of parenthood in general; climbing a tree brought color, a hand, and a mind—and something of a voice; and on descending, we find ourselves endowed with a mixture of unwanted heritage and the beginnings of spiritual grace. We start with life and sex, and we are left with love and an eye for beauty. Where we go from here, I do not know.
>
> BENTLEY GLASS

GENERAL AND SYSTEMATIC BOTANY

TASCHENBUCH DER BOTANIK. *Erster Teil. Morphologie, Anatomie, Fortpflanzung, Entwicklungsgeschichte, Physiologie. 16th Edition.*

Founded by Hugo Miehe; revised by Walter Mevius. Georg Thieme Verlag, Stuttgart. DM 10.50; $2.50 (paper). viii + 287 pp.; ill. 1955.

This represents a German version of an introductory textbook in botany, and as such it is obviously more comprehensive, detailed, and difficult than a comparable American text. Part of the differences may be explained by the differences in our educational systems, but it is also clear that no concessions are made to the German student by watering down a scientific presentation. As the title indicates, the subject matter covers the descriptive and development phases of botany, with genetics, ecology, classification, and evolution to be included in other volumes.

TEXTBOOK OF THEORETICAL BOTANY. *Volume II.*

By R. C. McLean and W. R. Ivimey-Cook. Longmans, Green and Company, London, New York, and Toronto. $18.00. xiii + pp. 1071–2201 + 1 pl.; ill. 1957.

Volume II of this projected 4-volume work was delayed by the untimely death of the junior author, but it is as excellent a treatment of the Angiospermae as the first volume (*Q.R.B.*, 28: 176. 1953) was of the more primitive plants. It is exhaustive in its treatment, the writing is a model of clarity, and the illustrations are numerous and pertinent. The first half of the book, nearly 600 pages, deals with the reproductive systems of plants: flowers, pollination, sexual reproduction; and seeds, fruits, and seedlings. The remaining pages are concerned with the families of angiosperms, the system of Engler being generally followed with the exception that the Ranales are kept in a primitive position, according to the views of Hutchinson. What is perhaps surprising to an American reviewer is that this volume, together with its companions, is written as a textbook for university students in England. American botanists, accustomed as they are to the segmentation of their subject matter, would have little use for so comprehensive a treatment, although it would serve them admirably as a reference source for lectures.

C. P. SWANSON

A COMPARATIVE STUDY OF *CHLOROCOCCUM MENEGHINI* AND OTHER SPHERICAL, ZOOSPORE-PRODUCING GENERA OF THE CHLOROCOCCALES. *Ind. Univ. Publ., Sci. Ser. No. 20.*

By Richard C. Starr. Indiana University Press, Bloomington. $3.00 (paper). viii + 107 pp.; ill. 1955.

The increasing role of microorganisms in genetic and physiological research demands a sound taxonomic knowledge as a basis for experimental studies. With this in mind, the author has examined, in unialgal culture, the generic limits of *Chlorococcum* and other related spherical, zoospore-producing genera. A number of new genera and species are described, and these, with the remaining known members of the group, were observed for long periods to determine what if any changes occur with the passage of time in culture. The results should help to clarify many of the problems of taxonomy and culture in this group of Chlorococcales, and the approach could well be applied to other unicellular forms.

COMMON FLESHY FUNGI.

By Clyde M. Christensen. Burgess Publishing Company, Minneapolis. $3.00 (paper). viii + 246 pp.; ill. 1955.

The amateur will find this a useful pocketbook for the

ready identification of fleshy fungi commonly found in the United States. A key at the beginning, and a glossary at the end of the book make identification relatively easy. Although sparsely illustrated, the black-and-white drawings incorporated into the key are quite adequate.

DIE LEBERMOOSE EUROPAS (*Musci hepatici*). *Eine Gesamtdarstellung der europäischen Arten. Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Österreich und der Schweiz. VI. Band, Abteilung 1, Lieferungen 4–5. Third Edition.*

By Karl Müller. Akademische Verlagsgesellschaft, Geest & Portig K.-G., Leipzig C1. (4) DM 20.- (paper); (5) DM 15.00 (paper). (4) Pp. 481–640; ill.; (5) Pp. xii + 641–756; ill. 1954; 1954.

The earlier published parts of this monograph dealt with the structure, cytology, ecology, geography, etc., of the European liverworts, as well as the systematics of the Anthocerotales and the Marchantiales. The above section, printed in two parts, treats the Jungermaniales in considerable detail, thus bringing the biology of the European liverworts up to date in rather comprehensive fashion. Bryophylists will find the monograph complete and well done, although much of the monograph is printed on a poor paper which tends to yellow rather quickly.

THE HETEROPHYLLOUS SELAGINELLAE OF CONTINENTAL NORTH AMERICA. *Bull. Brit. Mus. (nat. Hist.), Bot., Vol. I, No. 8.*

By A. H. G. Alston. The British Museum (Natural History), London. 16s. (paper). Pp. 219–274 + 2 pl. 1955.

Selaginella is a world-wide genus of some 2000 species, of which 30 of the heterophyllous forms are to be found on the continent of North America. These, together with 25 related species found in the West Indies and Central America, are listed by the author with collection points, descriptions, and range. A key is provided for classification purposes.

A MANUAL OF AQUATIC PLANTS.

By Norman C. Fassett; revision appendix by Eugene C. Ogden. University of Wisconsin Press, Madison. $6.50. ix + 405 pp.; ill. 1957.

An innovation was made in plant identification manuals in 1940 when Fassett's *Manual of Aquatic Plants* was first published by McGraw-Hill, with its emphasis on ease of identification, especially of sterile or out-of-season specimens. The book was hailed by the uniformly favorable press as "helpful," and the *Quarterly Review of Biology* (16: 365. 1941) and other journals stressed the "finely executed illustrations which occur on almost every page." Particularly noticed was the integration of text with the "wealth of illustrations," the text, as Fassett insisted, being "essentially a set of directions for looking at the pictures." Without doubt, the *Manual* was the most widely known of the late Norman Fassett's publications.

The University of Wisconsin Press has now published a reprint of this classic, to which are appended twenty-one pages of supplementary matter (keys, range extensions, and the like) by E. C. Ogden, New York State Botanist and well-known student of *Potamogeton*. This review will naturally concern itself, then, with the Revision Appendix. As an announced attempt to bring "nomenclature into agreement with present-day usage" in Fernald's and Gleason's recent manuals, Ogden's work is bound to be curious, because, by the nature of things, these authorities will not be in agreement. Hence Ogden has *selected* from these several publications the interpretations which he believes to be correct. This is fair enough, but not exactly what the dust jacket promises. There is no indication in Ogden's notes of the *kind* of change involved—whether it is an interpretation of a fundamental taxonomic sort, a simple synonym, or new knowledge. It would be valuable to know the *basis* for the *addendae et corrigendae*, and advantageous to have important materials set apart, by contrasting type, from mere conversions of "var." to "forma" in many instances. This would have given emphasis to the new materials. The citation of recent revisions often merely suggests the subject revised. For example, the full import of the *Typha* study made by Hotchkiss and Dozier (1949) is hidden beneath a casual remark on the hybrid nature of *Typha glauca*. Again, references of wide general interest might have been listed separately. For example, Eyles' and Robertson's "*A Guide and Key to the Aquatic Plants of the SE. U. S.*" (1944), though essentially a compilation from published sources, will be welcomed by the user of the *Manual* who is confronted by southern species.

The next revision of this classic must be complete, and it should be a generic manual of national scope. The inclusive approach to aquatic plants should be maintained and extended. Trees of characteristically lakeside or streamside habitats should be included. For example, the river birch, *Betula nigra*, should be included, as Hastings remarked in his review of the first edition of the *Manual*. Western genera like *Anemopsis*, which may vary in their habitats from strong saline to scarcely alkaline, obligate species of hot springs; genera associated with waterfalls—*Podostemon* made the first edition!—and genera of timberline rills, such as *Primula* and *Trollius*, should be included. It may be argued that there is no stopping; but the criterion

should be simply that of a plant intimately associated with water, whether it be a quiet Walden pond or a Southern blackwater swamphole, a tarn in the Rockies or an irrigation ditch beside a Mexican worker's shanty. Synoptical keys, or in many instances references to the more important sources where keys and descriptions may be found, as in Kearney's and Peebles' *Arizona Flora*, will carry the reader to his local destination. Generalized maps, such as those found in Martin's and Uhler's *Food of Game Ducks in the U. S. and Canada* (1939) are worth a thousand words apiece. But keep those excellent illustrations! They are among the best in American botanical literature. Turn to p. 190 and enjoy yourself.

JOSEPH EWAN

F. SCHUYLER MATHEWS' FIELD BOOK OF AMERICAN WILD FLOWERS.

Completely revised and enlarged by Norman Taylor. G. P. Putnam's Sons, New York. $5.00. xxx + 601 pp. + 31 pl.; text ill. 1955.

The field naturalist, particularly the amateur variety, will welcome the revised and enlarged edition of this familiar guide to the wild flowers of eastern and north-central America. The need for revision was made evident by the recent publication of the 8th edition of *Gray's Manual* and by the revision of Britton and Brown's *Illustrated Flora*. Both of these volumes are too complex and too difficult for the naturalist who is interested in only a casual acquaintance with a flora, but Norman Taylor, who has done the present revision, has followed Britton and Brown wherever controversy exists. The result is a most compact and dependable guide.

SPRING FLORA OF WISCONSIN. *Third Edition, revised. By Norman C. Fassett; revisions by Margaret S. Bergseng. The University of Wisconsin Press, Madison.* $2.50 (paper). vi + 189 pp.; ill. 1957.

The best local floras are aromatic when bruised. Fassett's *Spring Flora of Wisconsin, A Manual of plants growing without cultivation and flowering before June 15*, third edition, is such a one. The reader is advised that the inner bark of *Ulmus rubra* is to be chewed; that not all birch bark peels; that the bark of hornbeam is ridged with a muscular look; that if he roots about in rich woods he may find Adam and Eve—and notice, it will be this year's Adam you will find attached to last year's Eve. You are told to watch for a rare pearlwort, *Sagina procumbens*, as you walk to the edge of the putting green; to look for the "seals of Solomon" and to distinguish thimbleweeds from tumbleweeds, bastard toadflax from broom-rape, Hokah bluebells from Blue Cohosh, calypso from caraway—plant names excite the senses.

"A manual, at best," writes Paul H. Allen, "is but a means to an end, a necessary evil whose primary purpose is to enable the user to identify the material at hand as easily as possible. Some manuals bog down in technical jargon, and others, unintentionally become vehicles for the display of the author's personal erudition. . . . Facility of recognition, by whatever means, should be the objective." Fassett was conspicuous in his lifetime for his happy facility in compiling fully useful manuals: both his *Manual of Aquatic Plants* and his *Grasses of Wisconsin* contain marked illustrations where, in the manner of Peterson's bird guides, critical features are tagged. Again, in this *Spring Flora*, the most critical feature of each plant is illustrated. Five species of *Cornus* are distinguished by their leaves, while bloodroot is distinguished from celandine by the colors of their plant saps. Students at the University of Wisconsin are fortunate to have such an excellent field guide; and the handy pocket manual should be a best-seller, too, among the women's garden clubs that flower in spring.

Happily we are spared swivel-chair names. Hapless folknameless plants appear as just plain plants, with only the botanist's label. It is well to repeat here the wise words of the late Willard Clute: "No real common names were ever *made*; they grew out of the needs of the common people to indicate the plants with which they were acquainted. The names made by the horticultural and business world for their guidance, are none of these, but merely 'trade names' with which botanists and plant students have nothing to do" (*Amer. Bot.*, 48: 84. 1942). "Embedded [in true common names] 'like a fly in amber,' lies many an idea that throws a flood of light upon the customs, habits, traditions, superstitions and even the early history of our race" (Ibid., 50: 75. 1944).

Following the philosophy of utility, Fassett has provided a new key to the Cruciferae, based on vegetative characters to help identify those scraps that may come to hand sans silicle. There are fresh revisions of *Viola* (21 species considered) and of *Asclepias* (11 species). The waterproof binding of this new edition is welcome.

Wisconsin has been made famous by Fassett's mapping of glaciated and driftless areas; and, though no effort is made in this *Spring Flora* to stress them, the phytogeographic facts crop out here and there. I'm sure that the student reading of the solitary station of *Rhododendron lapponicum* in the Wisconsin Dells, the only known locality west of the Adirondacks and south of Hudson Bay where it occurs, would be led to ask questions. This is as it should be. For though the *primary* aim of the manual is identification, as Allen remarks, there are secondary aims worth the printer's ink. The only conspicuous secondary aim that's wanting in this charming little guide-in-hand is an historical

comment. For example, it might have been noted that the name *Phlox divaricata* var. *laphami* commemorates Increase Allen Lapham (1811–1875) whose collecting in the vicinity of Milwaukee and sending of notes and specimens to Asa Gray greatly advanced the knowledge of the Wisconsin flora; that *Polytaenia nuttallii* commemorates Thomas Nuttall (1786–1859), first botanist to collect in the state, who made the Fox-Wisconsin portage in 1810 to Prairie du Chien and down the Mississippi; or that *Cardamine douglassii* is named for David Bates Douglass (1790–1849), who accompanied Governor Cass in 1820 and collected nearly a hundred species in the state. The capitalization of specific names might be dropped in a fourth edition, following the recommendation of the International Rules of Botanical Nomenclature. *Oxalis dillenii* was missed in the capitalization process; *Alyssum alyssoides* would not be capitalized under any code.

Doesn't black nightshade (*Solanum nigrum*) flower in Wisconsin in the spring? Lapham lists it as there in 1853. Where is *Lamium amplexicaule*? or *Trifolium incarnatum*? And though the chenopods and amaranths are emphatically summer weeds, they are surely in flower before the final examinations. They should be included in the next edition.

But no such forgotten details should cast a shadow on the bright success of this pocket manual. Fassett had completed about one-third of the manuscript before his death in 1954; his colleagues at Madison and G. N. Jones of Urbana have carried this posthumous edition to completion. It was wise, too, to have the type set in Holland—a realistic approach to the rising costs of publishing scientific books. There can be no doubt: this *Spring Flora* would have pleased Norman Carter Fassett.

JOSEPH EWAN

THE BROMELIACEAE OF BRAZIL. *Smithson. misc. Coll., Vol. 126, No. 1. (Pub. 4184).*

By Lyman B. Smith; illustrated by Robert J. Downs. Smithsonian Institution, Washington. $3.50 (paper). viii + 290 pp.; ill. 1955.

This monograph opens with a historical account of past studies of Brazilian bromeliads and a statement of the sources of material used by the author. Brief general notes are given on the origin and distribution of some taxa: the Bromelioideae are said to have evolved in Brazil, and the Tillandsioideae may have had "three routes of invasion and also a strong reverse movement in the case of *Vriesia*."

The economic importance of the bromeliads is briefly discussed. The most important, *Ananas comosa* (the pineapple), with its delectable fruit, probably evolved in interior Brazil. With difficult preparation, it can provide a good fiber which is much less used than that of another bromeliad, *Neoglaziovia variegata* (caroa). Spanish moss (*Tillandsia usneoides*) is not as prolific in Brazil as in the United States and is little exploited. Many Brazilian bromeliads are used ornamentally in various parts of the world, and an increased interest in them led to the formation of the Bromeliad Society in 1950. Bromeliad tanks in a few coastal areas provide a breeding place for certain malaria-carrying mosquitos.

Under Preliminary Records the author has wisely separated descriptions of his 41 new species, 12 new varieties, and 16 new combinations. The Systematic Treatment includes a descriptive key to 3 subfamilies (Pitcairnoideae, Tillandsioideae, and Bromelioideae) and 35 genera. Each genus of more than one species is provided with a descriptive key. Best represented are the following genera: *Vriesia* (95 species), *Aechmea* (80), *Dyckia* (55), *Tillandsia* (44), *Neoregelia* (38), *Billbergia* (37), *Pitcairnia* (27), *Nidularium* (22), and *Cryptanthus* (20). Ample synonymies are given for the genera, for 453 species, and for many varieties; but descriptions are limited to the keys. Geographic data give known distributions in Brazil and elsewhere, if pertinent. Excluded and doubtful taxa number 29 species.

One item which will prove of considerable value to future students of Brazilian biology is Smith's long list of cited localities which do not appear in the "Index to Map of Hispanic America 1:1,000,000" of the American Geographical Society. The monograph ends with an index to taxa. The monograph appears to be a valuable contribution, but can be better evaluated after several years' use by workers in the field.

A. J. SHARP

SYSTEMATIC STUDIES ON ASTRAGALI OF THE NEAR EAST (*Especially Palestine, Syria, Iraq*).

By A. Eig. The Israel Scientific Press, Jerusalem; [Interscience Publishers, New York and London]. $4.50. 187 pp. + 8 pl.; text ill. 1955.

Astragalus (Leguminosae-Papilionatae) is a very important genus in the floras of the western part of North America, Central and southwest Asia, and the Mediterranean region, mostly in arid and semi-arid country. It includes such important plants as the locoweeds, certain selenium accumulators, and certain uranium indicators. It is said to be the largest genus of flowering plants. In the present state of knowledge it would be impossible to give even a reliable estimate of the total number of species.

This paper by A. Eig is an extensive series of critical notes and descriptions of new species, subspecies, and varieties. In addition to descriptions of new entities, an attempt is made to clarify a great many already known but confused entities, and many of these are here reduced to synonymy. An important feature of the paper

is a photograph and an analytical drawing of each species. One could dwell on the fact that this practice might be profitably emulated in modern taxonomic works generally.

This paper was written twenty years ago, but because of the war and events preceding it, and because of Professor Eig's death in 1938, it was not published until 1955. All students of *Astragalus*, as well as those interested in the flora and vegetation of southwest Asia and contiguous regions owe Mme. Ita Eig-Factorit a debt of gratitude for seeing this work through to publication. It is by no means the final word on *Astragalus*, but rather a contribution toward a monograph. There are nomenclature flaws, some from wrong interpretation of the rules of nomenclature, others perhaps from the fact that the rules have been changed since the paper was written. For example, the name *Astragalus emasaensis* Eig (p. 49) cannot be regarded as legitimate, as it was proposed for use in case *A. aleppicus* var. *macrocarpus* Eig should turn out to be specifically distinct. Inadequate material was available for final disposition of some of the forms considered. But there is no question that all future work on *Astragalus* in the Near East must start from this paper as a foundation.

F. R. FOSBERG

VASCULAR PLANTS OF THE PACIFIC NORTHWEST. *Part 5: Compositae. Univ. Wash. Publ., Biol., Vol. 17.* *By Arthur Cronquist; illustrated by John H. Rumely. University of Washington Press, Seattle.* $7.50. vi + 343 pp.; ill. 1955.

Although *Compositae* is Part 5 of this study, it is the first to be published. Library cataloguers should also note that the entire 5-part work, *Vascular Plants of the Pacific Northwest*, will comprise Volume 17 of the University of Washington Publications in Biology.

According to the blurb on the jacket of the present volume, the finished work will offer "the first complete guide, with keys, to the ferns, fern-related, and seed-bearing plants of Washington, northern Oregon, Idaho north of the Snake River plains, the mountainous western part of Montana, and Southern British Columbia." The list of titles shown for the forthcoming parts, however, indicates a more restricted scope. These, in inverse order of their contemplated publication, are Part 1: Monocotyledonae and Key to the Families; Part 2: Dicotyledonae, through Rosaceae; Part 3: Dicotyledonae, Leguminosae through Cornaceae; and Part 4: Dicotyledonae, Gamopetalae to Compositae.

The present volume, by Arthur Cronquist, presents detailed descriptions of the genera and species of the composites, including common names; distribution data; habitat; flowering periods; and complete synonymy. Technical keys to the tribes and genera are followed by strictly artificial keys for more convenient use. Each species described is illustrated by detailed drawings of excellent quality.

Cronquist's *Compositae* clearly sets a high standard of quality for *Vascular Plants of the Pacific Northwest;* and, if this standard is maintained in the subsequent parts, a botanical bible for the region appears to be assured.

SCOTT S. PAULEY

SUPPLEMENT TO THE CATALOGUE OF THE VASCULAR PLANTS OF S. TOMÉ (*With Principe and Annobon*). *By Arthur Wallis Exell. British Museum (Natural History), London.* 12s. 6d. (paper). vi + 58 pp.; ill. 1956.

THE ROMANCE OF TREES IN FACT AND FANCY. *By Mary Funk Hazel.* xii + 117 pp.; ill. 1955.

If the reader likes a sentimental description of trees, with prose and poetry intermingled, an emphasis on romance and fancy, and little emphasis on fact, this is the book. It is recommended only for light and pleasant reading.

PLANT MORPHOLOGY

THE STRUCTURE OF WOOD. *By F. W. Jane. The Macmillan Company, New York.* $9.50. viii + 427 pp.; ill. 1956.

Few topics in the field of plant anatomy have commanded as much attention in specialized texts as has wood structure. This recent contribution should be well received for its comprehensive presentation of fundamentals and its attention to the procedures and problems of wood identification. Not intended as a compendium, it is written primarily for students of wood technology, but the more general botanist should also be able to use it for basic information on wood structure and some related systematic aspects. The book is highly readable, the material well integrated and presented in a direct style.

In the first chapter, which is devoted to the names and classification of timbers, there is a useful appendix of the more important genera and species (common names included) by families, arranged according to Engler and Prantl. This treatment, and the more specific systematic considerations elsewhere, should be particularly helpful since they are put on a world-wide, rather than a regional, basis.

Beginning with Chapter 2, which considers the histology of wood, approximately one-third of the book is devoted to the fundamentals of microscopic structure, gross organization, and function of wood as a component of the living tree. A general discussion of atypical trees and timbers, emphasizing so-called anomalous organization, is included. Chapters 8–11 consider, respectively, the ultimate structure of wood, or the physics and chemistry of cell walls; variability, including abnormal and diseased wood; figure in wood; and properties and uses in relation to structure. The last chapters, concerned with wood identification, treat general principles, the diagnostic characters of important coniferous genera, and distinctions among the members of selected groups of hardwoods. An appendix deals with the elements of technique for wood anatomy.

Over 500 photographs and drawings supplement the text and enrich it markedly. Structural features illustrated by photomicrographs are shown clearly, and the preparations selected for photography were generally of high quality. Reference to the subdivisions of some plates could be improved by more consistent relationships between arrangement and sequence of descriptions of the individual illustrations. Five instances of erroneous figure citations were noted in the text.

The technical information given is generally accurate, and terminology follows accepted patterns; but in a few instances descriptions are too limited or are not precise. For example, the designation of vessels as conducting elements (p. 32) conflicts with the use of the term "element" in referring to individual tracheary cells; and the phrase, "component parenchyma cells" (of vessels, p. 38), is likely to be confusing. In treating secondary thickening in monocots, it is stated that cells cut off to the inside of the cambium develop into entire bundles; but the fact is that all internal cells are not thus involved. There are certain inconsistencies in the treatment of subjects. Primary pit fields, described as wall structures of cambial initials, are subsequently referred to as simple pits. Wood parenchyma cells of *Sequoia* are noted to remain alive for 100 years (p. 55), but later (p. 71) for only 70 years. One or two dicots are said to be devoid of vessels (p. 107), and elsewhere it is stated that a few genera, three of which are named, are vesselless. Both statements are glaring inaccuracies in view of the fact that vesselless dicots in fact number over 100 species in 10 genera.

Certain statements deserve comment because of their inadequacy or inaccuracy. It is said that the secondary wall does not form over primary pit fields and that, in these regions, pitlike structures are built up. In many cases, however, this is not true; and where pits of the secondary wall coincide with primary pit fields the two seldom correspond precisely. Related structures, crassulae or bars or rims of Sanio, are attributed to localized thickening of the middle lamella; otherwise intercellular material, rather than primary wall, is designated consistently as middle lamella. In the brief discussion of phloem as a cambial product, the enucleate condition of mature sieve tube elements is explained as the result of the inclusion of the nucleus in the protoplasm of the companion cell during division. Such an explanation is obviously not in accord with the widely recognized fact that in sieve tube elements the nucleus, present when the cell is delimited, degenerates during maturation.

In a book that does not attempt an exhaustive treatment, it is understandable that treatment of many topics must be limited. Thus, the various schemes which have been used for classifying imperforate or fibrous elements, parenchyma distribution, and ray types are not elaborated or explicitly related to descriptive categories followed in the book. The concept or terminology whereby the cells of the ground mass of imperforate tracheary elements in dicot woods are designated as tracheids, when pits are abundant and equal in size to those of vessel elements, is not recognized. Such elements are generally termed fiber-tracheids, emphasis being given otherwise to vasicentric and vascular tracheids. All would not agree that "it is probably correct to regard the vasicentric tracheid of hardwoods as the cell which is equivalent to, or homologous with, the vertical tracheid of the softwood," or that, ". . . tracheids of hardwoods normally receive scant attention." Ray classification here differs from the widely recognized scheme of Kribs on which it is based. Most striking, perhaps, is that there is no provision for distinguishing, among the woods with homogeneous rays, those with only multiseriate types from those with both uniseriates and multiseriates. Moreover, in spite of pronounced ontogenetic changes, ray characteristics are not included among those features in which twig and trunk wood differ.

The aspects of the book on which the above comments are based, and the few others which might be noted, in no sense constitute obstacles, particularly not for the beginning student. On the other hand, greater elaboration of pertinent developmental material, especially that relating to ontogenetic modifications of the cambium, would no doubt enhance a student's appreciation of wood as a component of the living tree and would provide a stronger foundation for understanding structural variability.

The author's thorough presentation of wood identification, including the use of keys, should be highly effective. Diagnostic features of selected groups of hardwoods and softwoods are reviewed in detail, and specific examples are used to demonstrate key construction. All in all, the book should provide a guide to a firm grounding in wood structure; and its objectives should thus be achieved.

CHARLES HEIMSCH

DER BAU DER PFLANZE. *Die Neue Brehm-Bücherei. By Walter Hellwig. A. Ziemsen Verlag, Wittenberg Lutherstadt.* DM 3.00. (paper). 56 pp.; ill. 1955.
This pamphlet contains brief résumés of cell, tissue, and organ structure, and is organized as a semi-technical introduction to the subject. Amateur botanists and naturalists constitute the intended audience.

PLANT PHYSIOLOGY

DIE BEDEUTUNG DER CHLORIONEN FÜR DIE PFLANZE, *insbesondere deren physiologische Wirksamkeit. Eine monographische Studie mit Ausblicken auf das Halophytenproblem. Bot. Stud., Heft 2.*
By August Arnold. Gustav Fischer Verlag, Jena. DM 10.70 (paper). viii + 148 pp.; ill. 1955.
In this monograph, the author deals exhaustively with the significance of chlorine in the plant kingdom, with particular attention to the higher plant forms. The major topics deal with chlorine assimilation and storage, its significance in the uptake of minerals and water, its concentration in the cell sap, and its relation to carbohydrate and hormonal production, to fruit and seed formation, and to morphogenesis. A final consideration takes up the question of chlorine tolerance and pathology.

ECONOMIC BOTANY

PLANT PROPAGATION.
By John P. Mahlstede and Ernest S. Haber. John Wiley & Sons, New York. $7.50. x + 413 pp.; ill. 1957.
This is a textbook for classes in plant propagation. It covers general principles of propagation, reproduction by seed, seed management, soil treatment, asexual propagation, propagating units, and details on the propagation of specific plants, including perennials, mushrooms, and ferns. Apparently the book was designed for students who have had no basic botany, since plant structure and development are discussed in considerable detail in the first few chapters.

The section on plant propagation by seed includes tables on types of pretreatment used to stimulate germination and on the longevity of the seed of most horticultural plants. The chapter on media and soil sterilization is brief but adequate. Chapters on plant propagation from cuttings, and those on budding and grafting, are detailed, complete, and well illustrated. The new Nicolien method of intershield budding as a compatibility bridge is described and illustrated, as is the recent use of a nurse root to propagate apple-dwarfing rootstocks. The rootstocks used for fruit and ornamental trees are listed with notes on hardiness and other characters; but the use of *Prunus tomentosa* and *P. besseyi* for dwarfing peaches is not mentioned, although they have been used by nurserymen for several years. A separate chapter is devoted to the propagation of important small fruits and ornamental plants.

This book is well organized and well illustrated. References to original articles and surveys are listed at the end of each chapter. It should be an excellent textbook for classes in propagation.

KARL SAX

SOILS AND SOIL FERTILITY. *Second Edition.*
By Louis M. Thompson. McGraw-Hill Book Company, New York, Toronto, and London. $6.50. ix + 451 pp. + 1 pl.; text ill. 1957.
In many agricultural colleges, the material in this book is presented as an introductory course in soils for freshmen. This seems a waste of time, since a basic understanding of chemistry and botany is needed for intelligent comprehension of the subject. In addition to students of agronomy and soils, advanced students in the fields of plant physiology, ecology, plant geography, horticulture, and conservation will find in this book a great deal of worthwhile information.

This second edition (first edition, 1952) has been brought up to date to include recent advances in soil chemistry and soil physics, with one notable exception. The author has failed to include any of the recent soil studies utilizing isotopes. During the last five years many fundamental problems have been studied with the aid of radioisotopes. This is particularly true with regard to the fate of phosphorus and calcium in soils. Though this is an elementary textbook, it seems that such new information might at least have been mentioned.

G. R. NOGGLE

ECONOMIC MARINE ALGAE OF TROPICAL SOUTH AND EAST ASIA AND THEIR UTILIZATION. *Indo-Pac. Fish. Coun. spec. Publ., No. 3.*
By J. S. Zaneveld. Indo-Pacific Fisheries Council, Bangkok, Thailand. Free upon request (paper). ii + 55 pp.; ill. 1955.
In western countries algae are utilized only in a minor way, compared with their extensive use in the Far East. Zaneveld's paper comprises information on the utilization of a great number of species, compiled from an extensive literature. Original work by the author is apparently not reported for the first time here, but his numerous papers are an important part of the literature cited.

For each species treated there is a list of vernacular names, a bibliography, a statement of geographical distribution, and one or more paragraphs on uses in different localities. It is really rather difficult to know what geographical area is covered as, in spite of the title, extensive information on uses in Hawaii is included, but on p. 3 "Japan, China, the Mid-Pacific Islands and Australia" are mentioned as not being within the region under discussion.

Sixty species in 29 genera are discussed, representing all of the four major groups of macroscopic algae. The vast majority are used as human food, but other uses are for pig food, fish food, fertilizer, medicine, magic, and to make commercial agar agar.

Bibliographies of literature on economic uses and on the taxonomy and geography of the economic algae of tropical south and east Asia are supplied. The paper is a very useful addition to the literature of economic botany.

F. R. Fosberg

Kinetics and Thermodynamics in Biochemistry. *By H. Geoffrey Bray and Kenneth White. Academic Press, New York.* $7.50. xii + 343 pp. + 1 pl.; text ill. 1957.

It was inevitable that the biochemist should turn to kinetics and thermodynamics for assistance in interpreting the data obtained from isolated biochemical systems. As the cellular activities were broken down to numerous individual enzyme-catalyzed reactions, the application of reaction kinetics made it possible to get information on the sequence of these reactions in the intact cell. Reaction chains were set up and evaluated in terms of kinetics. Furthermore, the kinetic approach enabled one to deduce the behaviour of whole systems. The use of thermodynamics has enabled the biochemist to gain insight into the mechanisms of energy transfer in living systems.

There are numerous examples of the use of kinetics and thermodynamics in the biochemical literature. The depth of treatment has varied tremendously, however; and there has been a need for the type of book written by Bray and White. In *Kinetics and Thermodynamics in Biochemistry*, the authors proceed from simple chemical reactions through complex reaction networks to a consideration of the whole organism. The coverage is thorough and includes such topics as structure and biochemical function, transport phenomena, oxidation-reduction reactions, reactions of organic phosphate compounds, kinetics of isotopic reactions, enzyme kinetics, pathways of free energy, and the control of metabolism. The discussions are geared to the level of the advanced student or graduate student in biochemistry, and it is assumed that the reader has some basic understanding of mathematics and physical chemistry. Biologists should at least be familiar with this phase of chemistry. Study of this book would reward them with a knowledge of what kind of problems can be tackled with the aid of kinetics and thermodynamics.

G. R. Noggle

The Role of Algae and Plankton in Medicine. *By Morton and David Schwimmer. Grune & Stratton, New York and London.* $3.75. x + 85 pp. 1955.

This short book is a charmingly written account of the fables, facts, and fantasies connected with the use of algae and plankton as food or medicine. No doubt at some time or other almost all varieties of plants and animals have been ingested by some enterprising, curious, or hungry human being. Those which taste good (some people would include kale, turnips, and parsnips) have been adopted into our diets, provided that their culture or capture is economically sound or feasible. Others have been adopted for their real or supposed medicinal, magical, narcotic, aphrodisiac, or other effects. The larger algae, and even some plankton, have not escaped the omnivorous human palate. Since anything strange or unusual arouses an expectation of unusual effects, it is not surprising that specific curative powers have been ascribed to various seaweeds. Some of these remedies, such as the feeding of agar for intestinal upsets or the use of certain seaweeds for goiter, have a sound medical basis. But by and large the medicinal use of algae is not substantiated by objective criteria of effectiveness.

This book dips briefly into various side-issues: the taxonomy of algae, economics of algal culture, the population problem, and specific diseases produced by ingestion of algal or planktonic toxins. Altogether, though much of the material it describes is less science than magic, this book affords a pleasant hour's reading. It should do little harm, for to become alarmed at its deficiencies would be quixotic.

Bernard L. Strehler

Handbook for Vegetable Growers. *By James Edward Knott. John Wiley & Sons, New York.* $3.95 (paper). vii + 238 pp.; ill. 1957.

This is a compact, concise volume containing a mine of information for both commercial and home growers of vegetable crops. All aspects of the problem are covered, with a large percentage of it in tabular form; and when further detailed knowledge is needed, literature citations are available. A good index is included, and a durable flexible cover to protect the book against hard usage. Its pocket size is an added convenience. No book now

on the market can compare with this one for sound recommendations and generally needed data for the grower.

C. P. SWANSON

RAUWOLFIA: *Botany, Pharmacognosy, Chemistry, & Pharmacology.*

By Robert E. Woodson, Jr., Heber W. Youngken, Emil Schlittler, and Jurg. A. Schneider; foreword by Arnold J. Lehman. Little, Brown & Company, Boston and Toronto. $5.50. xii + 149 pp. + 13 pl.; text ill. 1957.

While tranquilizers provide themes for the cartoonist, serious symposia on the therapy of hypertension, on the part that reserpine plays in it, and on the alkaloids of *Rauwolfia* that include reserpine, also come from the presses. This book is a digest of four fields of study of a plant genus more or less related to the garden periwinkle. *Rauwolfia* has been known to the Western World pictorially since 1755, when an engraving of it was published in Amsterdam in a classic compendium, Rumpf's *Herbarium Amboinense*, based on discoveries that accompanied the exploits of the Dutch East India Company. Long before that, the medicine men of India had known *Rauwolfia* as a minor drug plant. During the past ten years quiet research and clinical tests have established the value of *Rauwolfia* as an effective antihypertensive; and most recently world interest in the root has literally boomed—so much so, that the Indian government has imposed intermittent embargoes on its export. Fortunately, knowledge of the drug and of its value to man is unrestricted. It is a tribute to modern science that so comprehensive a summary of this knowledge as we have in the present volume could be organized and published with timeliness.

The book, a model of its kind, summarizes information on the *Rauwolfia* root from four approaches. It is written by a quartet of "world-famous experts in their fields": Woodson, writing on botany; Youngken, on pharmacognosy; Schittler, on chemistry; and Schneider, on pharmacology of the plant. The publishers have added an attractive touch with the use of a two-color title page in good taste, in the tradition set by the colors of the Rumpf title page, which is reproduced in facsimile and translated from the Latin by Woodson. This quiet commentary on our age reminds us that tranquilizers, though today's news, are really old stuff in a new chemical setting. The illustrations, throughout the book, have been chosen for quick reference; and the index has been carefully prepared.

There was a period in science when each monographer wrote for the next monographer. This has changed. Now Woodson, a specialist on the family Apocynaceae, writes a chapter explaining everything from the phraseology of the Rules of the International Code of Botanical Nomenclature to the character of the hypodermal periderm, and making it all intelligible to his fellow scientists across the partition who may be concerned with alloyohimbanes and their corresponding tetradehydro derivatives, or with the computations of mean carotid blood pressure.

JOSEPH EWAN

DAS MORPHOLOGISCHE SYSTEM DER KULTURTOMATEN (*LYCOPERSICON ESCULENTUM* MILLER). *Züchter, 3. Sonderheft.*

By Chr. O. Lehmann; edited by H. Stubbe. Springer Verlag, Berlin, Göttingen, and Heidelberg. DM 15.– (paper). iv + 64 pp.; ill. 1955.

Lehmann's monograph is essentially a descriptive treatment of the garden tomato and its many horticultural forms. In particular, type specimens of varieties and related species are given in great detail, and only the occasional breeder or taxonomist will find this of more than passing interest.

WHEAT-CLIMATE RELATIONSHIPS AND THE USE OF PHENOLOGY IN ASCERTAINING THE THERMAL AND PHOTO-THERMAL REQUIREMENTS OF WHEAT. *Based on Data of North American and Some Thermally Analogous Areas of North America in the Soviet Union and in Finland.*

By M. Y. Nuttonson. American Institute of Crop Ecology, Washington. $3.50. x + 388 pp.; ill. 1955.

BIOLOGISCHE BESONDERHEITEN DER EICHE UND MASSNAHMEN ZUR VERBESSERUNG IHRER NACHZUCHT.

By Mako P. Dakow. Akademie Verlag, Berlin. DM 9.50. vi + 130 pp. + 1 pl.; text ill. 1955.

This volume deals with the problem of the improvement of oak forests in Bulgaria. The theoretical considerations are based on a general acceptance of Lysenkoism, and its applicability to the improvement of an economic plant. The references are very largely from Slavic journals. Its interest to American foresters, therefore, will relate to the application of Dakovian-Lysenkoism to forest management rather than to the practical aspects of the subject.

A WORLD GEOGRAPHY OF FOREST RESOURCES.

Edited by Stephen Haden-Guest, John K. Wright, and

Eileen M. Teclaff. Ronald Press, New York. $12.50. xviii + 736 pp. + 54 pl.; text ill. 1956.

This is a well organized, up-to-date, and authoritative international symposium by no less than 35 contributors on the subject of the world's present forest resources and their role as an essential element of man's environment. The first five, and the last, of the 31 chapters are devoted to forest products and forest influences in their world-wide aspects. The remaining 25 chapters are concerned with the current forest situation and with problems in specific forest regions. These chapters are thoroughly documented, well mapped, and otherwise illustrated, providing essential information for professional workers and students in forestry, geography, and related fields. Authors of these chapters are, with but few exceptions, men who are, or have been, active leaders in forestry teaching, research, or administration in the countries concerned. The current reports on the forestry situation in the U.S.S.R., by Raphael Zon, and in China, by D. Y. Lin, will be of special interest to foresters and others concerned with the present and future of the world's natural resources.

The book is well illustrated with maps and graphs, most of which were prepared especially for the text by the American Geographical Society's cartographic staff. An excellent series of photographs depict various forest types, species, products, etc. The editors have thoughtfully included a table of conversion factors for the metric and English systems of measurement. A detailed botanical index and a general index are included.

SCOTT S. PAULEY

ACTA FORESTALIA FENNICA, *63, 64. Publications of the Society of Forestry in Finland.*

Society of Forestry, Helsinki. (63) viii + 142 pp.; (64) 263 pp.; ill. 1956.

This journal, published irregularly, contains treatises dealing with forestry in Finland and its foundations. Volume 63 and a part of volume 64, both published in 1956, contain a series of 8 papers by L. Heikinheimo of the Institute of Forest Economics at the University of Helsinki, and others, on the sociological aspects of forestry in Finland. The economic, and doubtless the biological, importance of such studies is attested by the fact that forest workers form approximately two-thirds of the male rural labor force in Finland. The articles are all in Finnish, but each is followed by a detailed summary in English. The numerous tables, graphs, and other illustrations in the Finnish texts carry titles, etc., in English as well as Finnish.

This series of papers appears to be of only a limited general biological interest. It will, however, be interesting to forest economists and sociologists. Biometrists may also be interested in the sampling techniques developed for the study.

SCOTT S. PAULEY

THE BRITISH MOORLANDS. *A Problem in Land Utilization. Univ. Ga. Monogr., No. 2.*

By John Fraser Hart. University of Georgia Press, Athens. $2.00 (paper). viii + 98 pp.; ill. 1955.

Britain is a crowded island, and the problems of living space and food production are becoming increasingly pressing as the demands of industry, agriculture, the military forces, and population grow. Only the moorlands, or the wet, peat-clad uplands, are open for further development, and the author's objective is to examine the thesis that these lands can be put to more profitable use. Forestry and agriculture vie with recreational, water, and military interests for the better areas, and while a solution is an imperative need, the author indicates that it is neither easy nor inexpensive to attain.

BIOLOGY OF ROOT-INFECTING FUNGI.

By S. D. Garrett. Cambridge University Press, New York. $5.50. xii + 293 pp. 1956.

Probably the most difficult of the plant diseases to control are those resulting from soil organisms. The effective agent is often difficult to identify; and even when known, control measures are hard to apply. Yet there are means—fungicidal, genetic, ecological, or antibiotical—which can be brought to bear on pests of the soil, and the author has, in balanced fashion, considered this problem in some detail. Consideration is given to the biology of agents causing diseases as well as to the problems of epidemiology. The volume represents a sound addition to the literature of plant pathology.

GENERAL AND SYSTEMATIC ZOOLOGY

INTEGRATED PRINCIPLES OF ZOOLOGY.

By Cleveland P. Hickman. The C. V. Mosby Company, St. Louis. $6.50. 956 pp.; ill. 1955.

Hickman's book is another in the long series of attempts to combine a "principles" approach with a "systematics" approach. However, with respect to space, the principles come out ahead with about 500 pages, as compared to about 400 pages devoted to systematics. This textbook apparently is designed to be used for two semesters, and it would probably not be feasible to try to use it in a one-semester course because of its length.

The order of chapters in a book is apparently a matter of opinion, and differs with each textbook author. The arrangement of chapters undoubtedly reflects both the author's ideas of the proper sequence of material and his effort to create a novel presentation. In fact, it sometimes appears that chapter arrangement is the major difference between textbooks. Chapter

headings and other devices commonly included in the table of contents are of value to the student as a guide to the organization of the course. There are no less than 50 chapters in this book. Such a large number of chapters is difficult to remember, and the student will tend to lose sight of the over-all plan of the course. Many of the chapters cover minor sidelines which might better have been included as parts of more basic chapters.

The author has in many places experienced difficulty in making his meaning clear. For example, the title of Chapter 9 reads, "The Basic Principles Influencing the Content of Animal Life." In this chapter the fundamental divisions of the science of zoology and certain zoological principles are discussed.

According to the author, most of the illustrations were made especially for the book. This feature is commendable. It affords an opportunity for the inclusion of new illustrative materials which may be copied by later textbook writers. However, few of the illustrations reproduced here will be copied anywhere. The drawings are not well done, and the photographs are frequently of preserved specimens. In general, the textbook is neither well illustrated nor well written. Other textbooks can be found which will be much more useful in teaching the science of zoology to college students.

TROY C. DORRIS

GUIDE TO THE LITERATURE OF THE ZOOLOGICAL SCIENCES. *Revised Edition.*

By Roger C. Smith. Burgess Publishing Company, Minneapolis. $2.75 (paper). viii + 135 pp. 1955.

Brought up to date once again, this unique publication (*Q.R.B.*, 29: 373. 1954) remains invaluable in training the young biologist how to locate information and how to keep up with his field.

LEHRBUCH DER SPEZIELLEN ZOOLOGIE. *Teil I: Wirbellose. 3. Lieferung.*

By Alfred Kaestner. Gustav Fischer Verlag, Jena. DM 7.50 (paper). Pp. 485–658; ill. 1956.

Continuing the series, the present Lieferung begins the treatment of the Arthropoda, covering the groups Trilobita, Merostomata, Arachnida, and Pantopoda. It gives a concise account of the anatomy and embryology and pays some attention to habits and physiology. It helps fulfil the purpose for which the series is intended—to provide, for advanced students of zoology, a handbook containing somewhat more information than the usual one-volume textbook.

L. H. HYMAN

DIE MILBEN DES SÜSSWASSERS UND DES MEERES. *Hydrachnellae et Halacaridae (Acari). Teil 1. Bibliographie.*

By Karl Viets. Gustav Fischer Verlag, Jena. DM 47.–. 476 pp.; ill. 1955.

The task of systematic zoologists is so overwhelming as to be considered impossible by many people. It is primarily the enormity of the task that is responsible for the impatience with which many non-systematists view systematists and systematic work. This impatience on the part of many, both systematists and non-systematists, has also resulted from time to time in proposals for developing new methods for handling the literally millions of items involved in the painstaking work of the systematist. Numerical systems, codes, mechanical sorting devices, revisions in the rules of nomenclature, and other expediencies have been tried. It has been found, nevertheless, that there is no short-cut that can bypass the tedious work required in amassing the information required for a catalog of a group of animals. It has also been found that once the catalog is published, it becomes the most useful of all reference tools.

Karl Viets, a life-long student and expert on the water mites, has produced an outstanding bibliography, catalog, and nomenclator of the Hydrachnellae and Halacaridae. The bibliography consists of over 4,000 references to work on these mites. It is arranged alphabetically by author and chronologically for works by the same author. The 163 text figures in the bibliography are small pictures of the authors of works cited. The catalog begins with a short history of work on water mites and an explanation of the organization of the catalog. One very important bit of information given in the introduction is an account of the important collections of water mites. The species are arranged alphabetically under each genus and the genera alphabetically by family, with the exception of the type species and genera, which in each case head the list. Families and superfamilies are arranged according to systematic position. The text figures in this part of the work are drawings of representative species of the genera, in many cases drawings of the type species.

The nomenclator is in reality a cross-referenced index. It consists of three lists of names arranged in alphabetical order as follows: (1) Superfamilies, families, and subfamilies; (2) Genera and subgenera with included species; and (3) Species with their associated genera. Following the name in each case is the page number of the location of the name in the catalog. In all three sections of the work there are two divisions. The Hydrachnellae, or freshwater mites, are treated first and are followed by a similar treatment of the Halacaridae, or salt-water mites.

The number of species involved, about 3,000, is not great when compared to the more than a million described species in the animal kingdom. Nevertheless, this catalog is extremely important because it can

provide ready reference to work done on this 0.3% of the animal kingdom. The world is in fact fortunate that Viets has devoted his life to the task of providing us with this account of three one-thousandths of the animal kingdom. Let us hope that the world will support enough dedicated systematists in the future for the entire animal kingdom to be properly cataloged.

G. W. WHARTON

CHIGGERS OF THE GENUS *EUSCHÖNGASTIA* (ACARINA: TROMBICULIDAE) IN NORTH AMERICA. *Proc. U. S. Natl. Mus., Vol. 106, No. 3364.*

By Charles E. Farrell. Smithsonian Institution, Washington. Free upon request (paper). Pp. 85–235 + 21 pl.; text ill. 1956.

Few new principles and approaches are discovered in systematic zoology. The theory is well established and techniques for describing, identifying, and classifying animals are, in general, well known. Nevertheless, despite the availability of satisfactory theory and practice, many systematic revisions and reviews are inadequate to the extent that they ignore these theories and practices. The present generic revision is outstanding because the author has followed accepted theory and practice. He has studied his material anatomically, geographically, ecologically, and experimentally. He has developed pragmatic definitions of his species that are consistent with genetic patterns. His analysis of the various systematic characters have led him to a reasonable classification of the group. A study of this revision will be worthwhile to demonstrate with what precision even a relatively obscure group of organisms can be treated systematically.

The genus *Euschöngastia* is represented by over 70 species, 15 of which were previously known from North America. To these Farrell adds 9 new species, which were discovered primarily through an intensive study of the parasites of small mammals in Pennsylvania and North Carolina. It is probable that similar intensive studies from other sections of North America would reveal additional new forms. Farrell's clear descriptions and new method of pictorial representation of species of *Euschöngastia* should make future studies of species of the genus much easier and more effective.

G. W. WHARTON

ANNUAL REVIEW OF ENTOMOLOGY. *Vol. 2.*

Edited by Edward A. Steinhaus and Ray F. Smith. Annual Reviews, Palo Alto. $7.00. vii + 407 pp.; ill. 1957.

The 20 reviews which constitute Volume 2 of this new series are equally divided between applied and basic entomology. Twelve of the contributions are from the British Commonwealth, seven from the United States, and one from Israel. The method of citing literature in the bibliography still displays the lack of uniformity which was exhibited in Volume 1. Thus, although the references are numbered consecutively, some authors have arranged their lists alphabetically and others in the order in which they are cited in the text. The former method is much to be preferred. In general, the literature surveys were completed in 1956.

There is some uneveness in the quality of the contributions, but on the whole they represent a valuable and satisfactory review of progress in the various areas of entomology. Nevertheless, one cannot help feeling that the volume is rather strictly limited to progress in the English-speaking world. It is to be hoped that future volumes will provide greater opportunities for reviews by entomologists from Europe and other countries of the world.

V. G. DETHIER

A SYSTEMATIC MONOGRAPH OF THE DERMAPTERA OF THE WORLD, *based on Material in the Brit. Mus. (Nat. Hist.). Part One, Pygidicranidae, subfamily Diplatyinae.*

By W. D. Hincks. British Museum (Natural History), London. £1 15s. (paper). x + 132 pp.; ill. 1955.

Among the earwigs, on the whole a little-known order of insects, the family Pygidicranidae is regarded as the most primitive. Within that family, the subfamily Diplatyinae is the largest. Three genera and 87 species are described, of which 1 genus and 26 species are new; 5 additional new species remain unnamed. The subfamily has a tropical and subtropical distribution, about like that of the primates, being found in South America and the West Indies as well as in the Old World, where it just reaches the Palearctic region in northeast Africa, the Himalayas, and perhaps in China. On the basis of the male genitalia, Hincks has revised the status of the group, unworked since 1904–15. "The large genus *Diplatys* is divided into regional groups of which the Ethiopian and the Oriental are subdivided into species-groups." The monograph displays the usual high standards of typography and illustration characteristic of the publications of the British Museum of Natural History.

CENTROCNEMINAE, A NEW SUB-FAMILY OF THE REDUVIIDAE (HEMIPTERA-HETEROPTERA). *Bull. Entomol., Vol. 4, No. 6.*

By N. C. E. Miller. British Museum (Natural

History), *London*. 15s. (paper). Pp. 217–283; ill. 1956.

The scope and usefulness of this publication is not indicated by its title. Actually, it is a monographic treatment of a curious group of assassin bugs which the author here elevates to the rank of subfamily. The principal character distinguishing the Centrocneminae from the other subfamilies of the Reduviidae is the rostrum consisting of four visible segments. In other assassin bugs, the rostrum consists of one hidden and but three visible segments.

Useful keys and excellent illustrations facilitate recognition of the 4 genera and 31 species that comprize the subfamily at present. Three of the genera and 23 of the species are new. So far, all species have come from the Indo-Malayan Subregion, where they are found in association with virgin forests. Although little or nothing is known of their habits, their structure appears to be suited to a life under loosened tree bark.

The eminently satisfactory style and arrangement of the revision is marred by one discordant note. The single subspecies is described from one specimen under the heading, "*Neocentrocnemis kinabaluensis* sub-sp. n." Only a comparative statement enables the reader to presume that *N. kinabaluensis* is a sub-species of *N. signoreti* (Stål). The latter species is recorded from Malaya, Sumatra, and Malacca and is common in Borneo where *N. kinabaluensis* was taken. In view of their possibly sympatric distribution, there would seem to be no reason why the two should not be treated as closely related forms having full species rank.

REECE I. SAILER

FISHES. *A Guide to Fresh- and Salt-Water Species. By Herbert S. Zim and Hurst H. Shoemaker. Simon & Schuster, New York.* $1.95. 160 pp.; ill. 1956.

This volume on fishes, another of the Golden Nature Guides sponsored by the Wildlife Management Institute, contains 278 color illustrations of familiar American species. This is a beautiful and excitingly illustrated book of pocket size and is one of the better examples of the printers' art. It is recommended for the person who has a casual interest in fishes and who wishes to learn more about those he is likely to encounter commonly in nature.

V. G. DETHIER

FISHES OF THE RED SEA AND SOUTHERN ARABIA. *Vol. I: Branchiostomida to Polynemida. By Henry W. Fowler. The Weizmann Science Press of Israel, Jerusalem.* $6.00. 240 pp.; ill. 1956.

Appropriately bound in red, this treatise deals with the fishes of the Red Sea and adjacent regions. The geographic coverage is indicated only, and not completely, by the title and by a statement on the jacket that it extends to "the Arabian shores, including the Gulf of Oman and the Persian Gulf." The text shows that there are included also the fishes not only of the Suez Canal but also those reported from Port Said, and therefore presumably from the Mediterranean.

This, the first of three projected volumes (of which the second will be a double volume), deals in Fowler-esque style with one lancelet and with the elasmobranchs, the malacopterygians, and other teleost groups generally termed Anacanthini, Heterosomata, Lophobranchii, Berycoidei, and Polynemidae (the nomenclature of groups of higher than family rank follows an unfamiliar formalized scheme once adopted but soon rejected by the American Society of Ichthyologists and Herpetologists). Deep-sea fishes are included, though such creatures will be examined almost exclusively by specialists who will not use a treatise of this type. This is almost strictly a compilation, made possible, in reasonable time, by the author's almost unparalleled knowledge of world fishes and command of their literature. Localities are given for specimens examined, but these are almost all extralimital. Some of the 117 figures are original, but many are copied.

More or less adequate diagnoses are provided for higher groups, families, and species. Keys to the higher groups, families, genera, and species, though curt, are not infrequently cluttered by unilateral rubrics, and will often prove inadequate or misleading, particularly when species not included are encountered. The figures are aptly termed "unfinished details," in the lamentable tradition of modern handbooks. *Halicampoides*, the only new name, is proposed for a genus of pipefishes not seen by the author.

The fishes of the Red Sea, known chiefly from the early work of Forskål (spelled Forskael), Rüppell (spelled Rueppell), and Klunzinger, are said to "have much in common with those of the Indian Ocean, with its great tropical marine faunas stretching far into the Indo-Pacific." It would be far more revealing to say that the Red Sea fauna is an integral part of the Indo-Pacific fauna, somewhat depauperate but with very considerable endemism—circumstances which have an oceanographic explanation. Fowler does just mention the very interesting passage of Red Sea fishes into the Mediterranean through the Suez Canal (partially restoring the ancient Tethys connection), but does not refer in general terms to the less known reverse passage, though the reported localities, usefully included in the synonymies, indicate movement in each direction.

Such interesting and significant speciational and distributional relations can be thoroughly analyzed only by critical studies of adequate material. For such researchers, as well as for popular use, this compendium

will prove time-saving and useful. But it, like many other compendia, will prove most valuable if it is not implicitly trusted.

CARL L. HUBBS

VARIATION IN THE WESTERN ZOSTEROPIDAE (AVES). *Bull. Brit. Mus. (nat. Hist.), Zool., Vol. 4, No. 7.*

By R. E. Moreau. The British Museum (Natural History), London. 35s. (paper). Pp. 309–433; ill. 1957.

The White-eyes (Zosteropidae) are an interesting bird family of the Old World tropics in which most species are of the same size, shape, and color pattern. Sympatric species are frequently more similar to each other in coloration than geographical races of a single species. The challenge which the classification and history of these birds poses to the taxonomist and evolutionist is obvious. A very detailed biometric (and qualitative) study of hundreds of population samples, combined with an analysis of habit specialization and altitudinal distribution have permitted Moreau to arrange the birds of the African mainland tentatively in four species. "Some of the most dissimilar birds are the most closely related." The coloration of the abdomen, white, grey, or yellow, on which previous classifications were largely based, varies individually and geographically within several species, and is taxonomically almost useless. Ecology and proportions are more revealing. Yet size and proportions are affected by climate and require detailed analysis to allow variation to be partitioned into the climatic and the species-specific components. For instance, wing length tends to increase by 0.69 mm. for every 1000 ft. of altitude and to decrease by 2.8 mm. for each rise of 10° F in the minimum temperature. The variation of tail and bill size likewise shows regularities in the continental populations. The variation of island birds, however, is very irregular. Moreau's study is a model analysis of a very difficult group of similar species.

E. MAYR

MAMMALS OF THE GREAT LAKES REGION.

By William Henry Burt. The University of Michigan Press, Ann Arbor. $4.75. xv + 246 pp.; ill. 1957.

Burt states in his Preface to this book that it "is, in fact, a revision of *The Mammals of Michigan* with species added to include the area surrounding the Great Lakes." Naturally the range maps for each species are all new. The changed format of the new work includes a smaller, handier size, but lacks the fine color plates by Grossenheider that graced the original work. It is pleasing to know that the usefulness of the original book was such as to engender republication in this somewhat expanded form, which makes the work of significance to a wider audience.

The book contains some general discussions of mammalian fauna, their economic importance, adaptations, home ranges, territoriality, and populations. This is followed by treatments of individual species in a taxonomic arrangement. For each species, the size, description, habitat, habits, and economic importance are given in addition to the range map.

It is regrettable that Burt did not take the opportunity to revise some of the species accounts more fully by incorporating some of the more recent findings. For example, it is disconcerting to find Conaway's fine paper of 1952 on the water shrew ignored by the statement that "the habits of water shrews are little known." Perhaps limitations of space prevailed, but a simple reference to such papers might have sufficed to fill the gaps in some species accounts.

There is a lucid section on methods of collecting and preparing specimens and a section on Classification of the Mammals of the World. This is followed by practical and useful artificial keys, one to skins or specimens in the flesh, and one to skulls only. A glossary of key terms follows. Additional handy features of the work include a table of dental formulae, and a complex table that contains data on measurements, number of teeth, number of toes and mammae, gestation periods, litter per year, young per litter, longevity, and home range—where such facts are known. Eleven pages of key references and an index complete the book.

Certainly everyone interested in the mammalian fauna of the Great Lakes Area should be grateful to W. H. Burt for providing such a handy reference work in so compact a form.

W. ROBERT EADIE

THE INTERRELATIONSHIPS OF THE NEW AND OLD WORLD HYSTRICOMORPH RODENTS. *Univ. Calif. Publ. Zool., Vol. 56, No. 1.*

By Stuart O. Landry, Jr. The University of California Press, Berkeley and Los Angeles. $2.40 (paper). Pp. 1–118 + 5 pl.; text ill. 1957.

Structural characteristics of the masseter muscle and enlargement of the infraorbital foramen are normally used as the basis of dividing rodents into three suborders. On the basis of morphological features common to both Old and New World forms, viz., hystricognath jaw, fusion of the malleus and incus, the proximal fusion of the tibia and fibula, breaking through of the pterygoid fossa to the orbit, and a special arrangement of the enamel prisms of the incisors, Landry concludes that the New and Old World hystricomorphs are related. Earlier investigators argued that the two groups could not be related since no Tertiary members of the suborder are known from North America.

Reclassification of the Histricomorpha involves splitting *Capromys* off from *Myocastor* and classifying it as a subfamily of the Echimyidae. This family and the American porcupines are placed in one superfamily, the Erethizontoidea. Tullberg's proposal that the basal split of the rodents was into sciurognath and hystricognath lines is accepted by Landry. Wood's evidence for deriving the South American hystricomorphs from Eocene North American paramyines is rejected. Hystricomorph dispersal is believed to have occurred in the Paleocene. The sciurognaths replaced the hystricomorphs in North America, but the latter survived in the West Indies, thence migrating to South America.

W. J. HAMILTON, JR.

ECONOMIC ZOOLOGY

PRODUCTION AND A PELAGIC FISHERY. *Fish. Invest., Lond., Ser. II, Vol. XVIII, No. 7.*

By D. H. Cushing. Her Majesty's Stationery Office, London. 12s. 6d. (paper). vi + 104 pp. + 1 pl.; text ill. 1955.

Plankton patches were contoured for numbers and identified from cruise to cruise by the methods described in Cushing (1953). From this technique rough age histograms were constructed for *Calanus finmarchicus*, which showed three points: (1) the heaviest mortality took place on copepodite stages IV, V, and VI—about 50 per cent fortnightly; (2) as the availability of plant food became reduced, recruitment to the naupliar stages and copepodite stage I was reduced; and (3) the numbers of adults were small until the pelagic fish disengaged from the "Calanus" patch and then they were quadrupled. From the mortality of *Calanus* which is based on the food chain from phosphorus through diatoms some assumptions are derived about the yield of herring.

D. E. DAVIS

AMATEUR BEEKEEPING.

By Edward Lloyd Sechrist; illustrations by Frank Norris Todd. The Devin-Adair Company, New York. $3.50. xii + 148 pp.; ill. 1955.

The proof of the worth of a manual is the success which attends the efforts of the average user. This book was given as a gift to a would-be amateur beekeeper. Judged by his success the book can be recommended as a useful volume. Actually, it does supply most of the information and does answer most of the questions which confront the average beginner. In some respects it is not as useful as standard manuals supplied to commercial beekeepers. These usually provide a wealth of illustrative material which is extremely helpful. The present volume, however, is quite satisfactory, and is especially attractive because it is written in a personal and conversational vein that combines pleasant reading with instruction. It is further lightened by the amusing illustrations of Frank Norris Todd.

V. G. DETHIER

POULTRY BREEDING. *Genetics and Systems of Breeding. Bull. Minist. Agric., Lond., No. 146.*

By G. E. Mann. Her Majesty's Stationery Office, London. 4s. 6d. (paper). viii + 150 pp.; ill. 1955.

This bulletin is written for the poultry breeder in Britain and should be interesting to all concerned with poultry breeding. It attempts to review what is known about the genetics and breeding of the domestic fowl, 2 pages being devoted to waterfowl and turkeys. This is both the strength and weakness of the bulletin It presents a large amount of information that one would only expect to find in a book, but this information must then be so compressed that the presentation is in some cases one-sided, incomplete, or both. Fifty-eight pages are devoted to the physical basis of heredity, "poultry genetics, and the genetics of breed characteristics. There follow 17 pages devoted to the inheritance of economic characters and then a wide-ranging discussion of systems of breeding. Here the emphasis in Britain on breed characters, on use of birds over one year old, and on the individual bird, all show through. There is, however, in the presentation a dash of the ferment which is currently changing poultry-breeding methods. With that in mind we can forgive the author for vigorously disposing of blood as a synonym for genes and then using blood in just that sense elsewhere.

A. S. ASMUNDSON

HATCHERY OPERATION AND MANAGEMENT.

By Ernest M. Funk and M. Richard Irwin. John Wiley & Sons, New York; Chapman & Hall, London. $6.50. viii + 349 pp.; ill. 1955.

This is a sound treatise on an important phase of our modern agriculture, and the authors have treated all aspects of a rather complicated practice with clarity and precision. Practical as well as theoretical considerations are judiciously balanced, and the text is supplemented with an excellent series of illustrations.

ANIMAL GROWTH AND DEVELOPMENT

VERTEBRATE EMBRYOLOGY. *Fourth Edition.*

By Robert S. McEwen. Henry Holt & Company,

New York. $6.50. xiii + 701 pp.; ill. 1957.
The fourth edition of McEwen's *Vertebrate Embryology* deviates only in minor details from the third, which has already been reviewed in these pages (*Q.R.B.*, 25: 92, 1950). The text and figures describing meiosis have been brought up to date and improved, together with the figure illustrating the gastrulation of the frog and the text dealing with gastrulation in the chick and with the development of cranial and autonomic ganglia in this form. Other less extensive changes are to be found scattered throughout the text, illustrations, and footnotes. Some new additions have been made to the bibliographies, most of them to that concerning the development of the frog. The changes in no way alter the character of the book, but serve to make it more accurate and modern than the previous edition.

JANE OPPENHEIMER

LABORATORY STUDIES IN DEVELOPMENTAL ANATOMY. *By Theodore W. Torrey. Burgess Publishing Company, Minneapolis.* $2.75 (paper). x + 114 pp.; ill. 1957.
This manual is designed for use in a one-semester course (15 weeks at 6 hours each in the laboratory). Like a number of its contemporary counterparts, it combines the treatment of comparative vertebrate anatomy and embryology. It begins with a study of ammocoetes larvae in whole mounts and cross-sections, proceeds to a brief survey of cleavage and germ-layer formation in various vertebrates, and then follows the development of the chick through the 72-hour stage. The remainder of the manual is made up of 5 chapters, each of which considers both the embryology and anatomy, in a single sequence, of selected organ-systems. These include skeleton, digestive system (including respiratory organs and body cavities), urinogenital system, cardiovascular system, and nervous system (including sense organs). Dogfish and fetal pig represent the principal materials employed for student dissection, but the study of these is supplemented by the liberal use of demonstration specimens of other species. The manual includes over 50 excellent figures, which are incorporated for purely expository purposes; the student is expected to make his own drawings. The directions for laboratory procedure are both sensible and clear, and the factual descriptions presented are eminently accurate. The manual therefore should be of considerable value for combined courses in anatomy and embryology.

JANE OPPENHEIMER

THE BIOLOGY OF SENESCENCE. *By Alex Comfort. Rinehart & Company, New York.* $4.00. xiv + 257 pp.; ill. 1956.
This short volume is surely one of the most incisive and stimulating ever to be written on the subject. It is not intended to be an indiscriminate review of the vast literature in the field of gerontology. On the contrary, while it is written in an entertaining and stimulating manner and deals primarily with evidence available from the more classical areas of biology, it is a book which is concerned more with an evaluation of ideas than with detailed evidence. Experiment is called upon as a test of one or another hypothesis rather than as a habitual or academic recitation.

The treatment given biological problems is all the more admirable in that Comfort is not primarily trained in biology, but rather in medicine. (Since the above was written, the reviewer has met Dr. Comfort and has learned that he is one of Britain's successful young novelists and poets. This may account, in part at least, for the delightful and lucid literary style of the book.)

Only two adverse comments. First, in my opinion, it is unfortunate that the mortality data are presented in terms of survivorship curves rather than age-specific death rates (since the latter give a direct index of the force of mortality). Second, one wishes that Comfort had finished by giving as thorough and critical an analytical treatment to the physiological, histological, and biochemical aspects of the problem as he has to the evolutionary, actuarial, and systematic phases of the field.

Gerontology is a field which could profit from a more incisive drawing together of the many lines of evidence which purportedly bear on the nature of the aging process. A concentration, organization, and analysis of ideas and data are needed if future research in the field is to be planned effectively. This book provides that requirement for a portion of gerontology; as such, it is in my opinion essential reading for all those who are interested in the biology of aging.

BERNARD L. STREHLER

ANIMAL MORPHOLOGY

VERGLEICHENDE ANATOMIE UND MORPHOLOGIE DER WIRBELTIERE. *II. Lieferung.*
By W. Marinelli and A. Strenger. Franz Deuticke, Wien. By subscription, Öst. S. 162.–; single copy, Öst. S. 180.–. 172 pp.; ill. 1956.
This second part of a projected series of 12 Lieferungen on vertebrate types is devoted to *Myxine glutinosa*. It constitutes an original contribution to the anatomy of the form. The volume is illustrated with numerous original drawings of dissections and transverse sections of the animal and should be of value to all students of vertebrate anatomy.

L. H. HYMAN

OSTEOLOGY OF THE REPTILES.

By Alfred Sherwood Romer. University of Chicago Press, Chicago. $20.00. xxi + 772 pp.; ill. 1956.

This is an outstanding book that will be referred to with justifiable confidence for many years. It is divided into two major sections: the skeleton of reptiles, and the classification and range of reptiles. While these subjects are treated in satisfying detail, there are also dividends in other information. For example, the first 45 pages are devoted to other systems, by way of an introduction to the skeletal system, and comprise a brief comparative anatomy of reptiles. The thoughtful treatment here of the muscular system deserves special mention.

Well over 400 pages are then devoted to a region-by-region description of the skeletons of reptiles. Following a general account for each region, there is a detailed summary for each of the various major groups of reptiles. Illustrations are good, although more would have been helpful. A serious effort to keep the book as concise as possible may explain the use, under one figure of a set of legends intended to serve for a series of figures. This procedure, common in British books, does save some space, but only at the cost, however, of easy use by the reader.

The second section, of about 250 pages, comprises an authoritative classification of living and fossil reptiles down to subfamily level. Under each family or subfamily, Romer shows the included genera, with generic synonyms and a brief indication of the geologic and geographic distribution for each genus. The classification is novel and exciting. Romer carefully documents the reasons for his groupings, and vertebrate paleontologists and herpetologists will find the arrangements most stimulating. The author frequently points out that certain groupings are speculative because of the paucity of information now available. In the treatment of genera, he is conservative. Further contributing to conciseness is the telegraphic style used in the morphological (primarily osteological) definitions of the taxa. In certain instances, a tabular presentation of some of these data might have made them easier to use.

There is a selected bibliography in excess of 500 titles and an extensive index of over 5,000 items. The book is a comprehensive compendium: carefully done, well documented, and clearly printed. It follows the arrangement of Williston's book (1925) by the same title, but Romer's book bears the same relation to Williston's that a new unabridged dictionary bears to an old abridged one.

Coverage of the literature is markedly complete; and errors, typographical or otherwise, are rare. Romer has missed, or fails to comment on, the remarkable paper of Dunn and Tihen (1944) in which a pectoral girdle is identified in a primitive burrowing snake. Again, probably through his effort to use as few words as possible, Romer makes a misleading statement about the pit-organ of the Crotalinae, which is used to detect thermal changes, when he says only that it is sensitive to heat.

Romer points out that it is difficult to make generic assignments of snake fossils since, for many of them, only vertebrae are known. Happily this problem is currently being resolved through the work of Walter Auffenberg, who has learned to distinguish fossil and living genera and, in many cases, species of snakes, through morphological study of vertebrae.

Other reviews of Romer's book which have already appeared are as high in praise as this one; but it is amusing to find that one reviewer, who ascribes an error to Romer, is wrong himself. Jay Savage (*Copeia*, 1957 (2): 165) states that Romer does not mention the classical term, Serpentes, whereas it is quite properly indicated on p. 566.

The book admirably covers its subject. There is a wealth of intriguing data that would permit interpretations of geographic distribution, and it is unfortunate that such a treatment is beyond the scope of this book. In carefully restricting himself to his topics, Romer rarely allows himself to indulge in such tantalizing generalizations as when, in discussing *Mesosaurus*, he writes: "The presence of these forms on both sides of the south Atlantic—and nowhere else—is a strong argument for intercontinental connections in this region in late Paleozoic times. These forms, although moderately aquatic in adaptations, can hardly be considered as able to cross such an area of water as the south Atlantic, and it is difficult to believe that they ranged, without discovered fossil material, over the long northern migration route demanded by theories of fixed continents."

This volume is a scholarly and encyclopedic account of the reptile skeleton and the history of the reptiles. It is a substantial contribution to our knowledge that will be of great value to morphologists and vertebrate zoologists for a long time to come.

ARNOLD B. GROBMAN

ANIMAL PAINTING IN ENGLAND, *from Barlow to Landseer. By Basil Taylor. Penguin Books, Baltimore.* 85 cents (paper). 71 pp. + 70 pl. 1955.

The depiction of animals by artists always possesses a certain charm for biologists, but the painters of birds (Gould, Audubon, and many others) and of flowers have more commonly been praised and studied for their special ability to catch the fleeting expression to convey the essence of form and character. Animal painters, to judge by the record of the British artists in this genre from Barlow to Landseer, have limited themselves too greatly to the familiar and tamed expressions of domesticated species—horses, dogs, cattle, sheep, poultry. The six color plates and 64 halftones in this Penguin Book represent some two

dozen artists, of whom only George Stubbs seems to have essayed frequently to paint wild animals. His baboon is very lifelike, but his rhinoceros must have been a stuffed specimen, and his tiger was certainly seen in some zoo. It is a difficult choice of object, no doubt—but somehow the sculptors seem to have succeeded where the painters were less successful. Barye was far beyond any of these painters in catching the spirit of an animal, even though some of these painters are reckoned among Britain's greatest. And no modern painter of animals, surely, can compare with the inimitable power and charm of Pompon's wonderful birds and mammals.

The text of this book offers interesting comment on the artists and their work. Like all Penguin Books, it is a splendid bargain.

BENTLEY GLASS

THE HUMAN FIGURE IN MOTION.

By Eadweard Muybridge; introduction by Robert Taft. Dover Publications, New York. $10.00. xx + 195 pl. 1955.

The *Human Figure in Motion* contains a selection of the pictures from the original 11-volume work entitled *Animal Locomotion*, published in 1887. This book might well be called the greatest single aid to any person who, knowing how to draw or paint the human figure, seeks to increase authenticity in his work. Its purpose is not to teach anatomy or figure drawing, but to serve as a ready reference and final court of appeal to the illustrator lacking the advantage of a model. Its many photographs show the human subject in all conceivable positions, and arranged in sequences. The average number of pictures per action is ten lateral and ten anterior or posterior; the average single picture is 1¼ x 2 inches. Most of these photographs are sufficiently clear and well lighted as to show the essential topography. The majority of the subjects are adults (male and female) undraped; a smaller number are partially draped. There is a less definitive section on children.

This book is a pictorial dictionary of human motion and is bound to produce an added vitality in the observation and drawing of the human figure.

WM. LOECHEL

PICTORIAL ANATOMY OF THE HUMAN FIGURE.

By Frederic Taubes. Studio-Crowell, New York. $3.75. x + 105 illustrations. 1956.

The aim of this book is to present drawings of the human figure relative to its topography, eliminating much of the reference to deeper structures found in so many books on figure drawing. This idea is a good one, yet the method of presenting the material is uninspiring. There is no text, but solely an informal sketch book with marginal notes. Each page is artistically composed (so as to retain the reader's attention), but one finds many of the individual sketches receiving no more emphasis than the embellishment flanking them. All of the drawings exemplify freedom; many indeed exemplify complete disorder, as though the author had labored with a minimum of time, with rough paper, and a post office pen.

WM. LOECHEL

THE ADRENAL CORTEX.

By I. Chester Jones. Cambridge University Press, New York. $7.00. x + 316 pp. + 9 pl.; text ill. 1957.

This essay is essentially a comparative one, covering the entire vertebrate phylum. The Preface states that the survey of forms is complete from the primitive vertebrates through the marsupials. But the literature on the Eutheria, which comprise the rest of the mammals, is so extensive that its coverage here is necessarily incomplete. Emphasis is placed on general background information and a survey of current problems. This chapter nevertheless comprises about half of the entire text and gives a detailed account of the gross anatomy, histology, and various functional aspects of the adrenal cortex. There are 35 text figures, mostly line drawings, and 45 photomicrographs in 9 plates. The list of references contains about 1100 items. This book, essentially an annotated review of a difficult and complex subject, is one for the specialist.

F. N. LOW

THE BILIARY TRACT, *with special reference to the Common Bile Duct.*

By Julian A. Sterling. The Williams & Wilkins Company, Baltimore. $10.00. x + 424 pp. + 2 pl.; text ill. 1955.

This moderate-sized volume is an attempt to encompass the anatomy, physiology, and pathology of the biliary tract in man in an orderly fashion. The author, who is a surgeon, has been particularly interested in some anatomical features of biliary tract disease, particularly with respect to the terminal common bile duct and the sphincter of Oddi. The most convincing portions of this text are those dealing with these subjects in which the author has himself been particularly concerned. Illustrations and presentation are excellent with respect to these points.

The rest of the volume does not fare so well. Much of the writing is grammatically loose, and often unclear. There is an obvious lack of compression of unnecessary

detail, so that lists of theories and differential diagnoses are strung out one to a line over many pages. On the other hand, in the chapter on Diseases of the Pancreas, the author's treatment is extremely superficial and does not deal in sufficient detail with the important methods by which the physician follows the course of this very serious ailment. The rationale for various forms of therapy in pancreatitis is hardly discussed, and recommended treatment is essentially symptomatic rather than physiologically directed. Chapter 7, entitled Laboratory Observations, is so sketchy as to be of no value whatsoever; in addition, many positive misstatements are made, and the lack of scholarship evident in the writing belies the extensive bibliography at the end of this chapter, as at the end of others. The sections on radiology of the biliary tract are in general quite good; the illustrations are well chosen and printed, the diagrams accompanying each radiograph being particularly helpful.

In summary, Sterling has written a book in which those anatomical and surgical features which interest him particularly have been well covered and discussed in a manner which brings clarity to the subject. In many other important areas, however, which have not engaged his personal attention, difficult and controversial subjects are not discussed in the thorough and painstaking manner demanded of a modern textbook in this field, and in addition, a number of rather carelessly worded statements may mislead the unwary. The book is well-produced, printed in a large legible type, on good paper, and the illustrations in general are well reproduced. The index is unduly long but appears accurate. It is my own opinion that the book does not add enough to our understanding of the physiology and pathology of the biliary tract to match the contributions it makes towards better understanding of the anatomy of this area. It is primarily a surgical work, with many details that are of value for the surgeon operating in this area, but it is deficient in the understanding it brings to the broader aspects of these problems.

ALBERT I. MENDELOFF

LYMPHATICS, LYMPH AND LYMPHOID TISSUE.

By Joseph M. Yoffey and Frederick C. Courtice. Harvard University Press, Cambridge. $10.00. vii + 510 pp.; ill. 1956.

Although this book is a revision of the long out-of-print Drinker and Yoffey volume of the same name, the inclusion of new material and of modern concepts makes it essentially new. Its general organization is primarily neither anatomical nor physiological, although a great deal of good information from both fields is presented. For example, there is an excellent account of the anatomy of the lymphatics and surrounding structures in Chapter 3, on the Physiological Significance of Regional Lymphatics. The 99 figures are mostly line drawings, but there are numerous halftones as well. There are 55 tables. The unusually extensive bibliography at the end of each chapter should do much to fill the void so frequently encountered in a search for concise and systematic information about the lymphatic system. This book is a scholarly and reliable piece of work and a welcome addition to the specialized literature on functional systems.

F. N. LOW

ANOMALIES DENTO-CRANIO-FACIALES. *Organogenèse, Morphogenèse, Perspectives, Thérapeutiques.*

By Maurice Lepoivre; preface by Maurice Lamy. Masson & Cie., Paris. 860 fr. (paper). 127 pp.; ill. 1954.

About half of this monograph is devoted to the normal organogenesis and morphogenesis of the face, cranium, and teeth. There follow chapters on the troubles of organogenesis, the nature of perturbing actions, and organopathies; on the troubles of morphogenesis; and on the role of heredity in these. The final major portion of the treatise is concerned with hereditary malformations and maladies of the mouth and teeth, especially the dental and osseous anomalies. The review will be of particular value and interest to embryologists and students of human and medical genetics.

The principal conclusion of the author is very well stated: "Les anomalies dento-cranio-faciales relèvent de 2 facteurs: hérédité et milieu ambiant. Hérédité et milieu ambiant agissent pendant tous les stades de la vie et peuvent se manifester de la conception à la mort." Under the direction of Professor Maurice Lamy a well-oriented school of medical genetics has developed in France, and this monograph is evidence of the fact. English-speaking geneticists will do well to keep themselves informed of the French studies in such fields.

BENTLEY GLASS

TRAVAUX D'ANATOMIE PATHOLOGIQUE OCULAIRE. *Première Série.*

By F. Hervouët; microphotographs by André Lenoir. Masson & Cie., Paris. 3,500 fr. (paper); 4,100 fr. (cloth). viii + 186 + ii pp.; ill. 1954.

Most of this treatise, which summarizes 16 years of work by the author, is devoted to the pathological anatomy of the eye and to fibroplasia, benign and malignant tumors, retinal detachments, retinitis, and the like. Certain chapters, however, describe the outcome of surgical grafts of sclera onto the cornea of the rabbit, and observations of epithelial proliferation at

the margins of a human surgical graft. These observations will be of some interest to embryologists as well as surgeons.

MODIFICATIONS OF PATTERN IN THE AORTIC ARCH SYSTEM OF BIRDS AND THEIR PHYLOGENETIC SIGNIFICANCE. *Proc. U. S. Natl. Mus., Vol. 104. No. 3346. By Fred H. Glenny. Smithsonian Institution, Washington.* Free upon request (paper). Pp. 525–621; ill. 1955.

ANIMAL PHYSIOLOGY

ESSAYS IN METABOLISM. *The John Punnett Peters Number of the Yale Journal of Biology and Medicine, Vol. 29, 1956.*

Edited by Louis G. Welt. Little, Brown & Company, Boston. $6.50. Pp. 175–382 + 1 pl.; text ill. 1957.

These papers were chosen for coverage of various fields of interest in which John Punnett Peters worked so fruitfully during his career. The articles are written by experts in each aspect of metabolism, and constitute excellent reviews.

The ten papers include: Whole Body Buffers in the Regulation of Acid-Base Balance; The Role of the Kidney in the Regulation of Acid-Base Balance; the Role of Sodium Salts and Adrenal Steroids in the Production of Hypokalemic Alkalosis; The Physiological Behavior of Rubidium and Cesium in Relation to that of Potassium; The Fate of Ingested Water; Renal Excretion of Sodium and the Concept of a Volume Receptor; the Influence of Disease on the Renal Excretion of Water; Serum Lipids in Different Phases of Carbohydrate Metabolism; The Metabolism of Fructose in Man; and Significance of Blood Sugar and Serum Electrolyte Changes in Cirrhosis Following Glucose, Insulin, Glucagon, or Epinephrine. Each of the articles is well documented with graphs, tables, and references; and each should prove of considerable value to advanced workers in metabolism and physiology.

R. VAN REEN

DIGESTION, *Parts 2 and 3–4. Tabulae Biologicae, Vol. XXI.*

Edited by H. J. Vonk, J. J. Mansour-Bek, and E. J. Slijper. Dr. W. Junk, Den Haag. (Pt. 2) Fl. 75 (paper); Pt. 3–4, D. Guilders 140 (paper). (2), xii + 251 pp.; ill. (3–4), viii + 404 pp.; ill. 1953; 1954.

The tables in this handbook of collected data were prepared before World War II, and one might question whether they have today any more than historical value. The present volumes, at any rate, complete the publication of the long-delayed work.

Part 2 is headed "Chiefly Vertebrates." It includes tables on the composition and secretion of the stomach juice in vertebrates (A. C. Ivy), pancreatic secretion (J. La Barre), the composition and secretion of bile (H. P. Wolvekamp, addendum by A. P. de Groot), composition and secretion of intestinal juice (H. P. Wolvekamp, addendum by A. P. de Groot), the composition of the stomach and intestinal contents in vertebrates, and the utilization of nutriment by vertebrates (H. J. Vonk), the resorption of physiologically important substances in the digestive tracts of vertebrates and invertebrates (B. J. Krijgsman), the composition of vertebrate feces (H. J. Vonk), the special digestive physiology of the ruminants (H. J. Vonk), and hormones of the digestive organs among vertebrates (C. Engel and C. Romijn).

Part 3 contains tables on the Invertebrates, compiled by C. M. Yonge (physiological anatomy of the alimentary canal in invertebrates; food of invertebrates; feeding mechanisms in the Invertebrata); by C. Romijn (the composition of the digestive organs of invertebrates); and by J. J. Mansour-Bek (digestive enzymes in Invertebrata and Protochordata; the composition of the digestive juices of Invertebrata). Part 4 is the index to the entire work.

It is surprising to see how few of these topics are tabulated in the new *Handbook of Biological Data*. There is thus probably still a need for these volumes, and it is to be hoped that in time they will be brought up to date.

BENTLEY GLASS

NEURO-ENDOCRINOLOGIE ET NEURO-ERGONOLOGIE, *Leur Rôle en Pathologie. (Chocs, Inflammation, Processus prolifératifs, Régénération, greffes et cancer). By Michel Mosinger. Masson & Cie., Paris; Coimbra Editora.* 3,500 fr. (paper). xxxvi + 754 + ii pp.; ill. 1954.

The thesis of the author is that neurology and endocrinology are destined to become united into a single basic branch of medicine because of the intimate relations between the nervous system and the glands of internal secretion. His book thus deals extensively with interconnections and correlations. The well-known relationships of the pituitary to the brain and of the pituitary functions to those of other endocrine organs unquestionably point to the very great importance of such correlations; and the recent discovery of a hypothalamic neurohumor which controls activity in the anterior pituitary serves to enlarge the probability

that more such will be uncovered. Whether the voluminous discussion of hypothetical relationships as well as demonstrable ones undertaken by the author in his own unique terminology and conceptualization is the best way to set forth such a viewpoint is more doubtful. A key statement which may be taken to illustrate Mosinger's approach is the following: "Ayant sous sa commande l'hypophyse, l'hypothalamus apparait comme le Centre principal de la Pathologie corrélative régissant l'Agressologie, la Phlogologie et l'Allergologie et intervenant dans les processus proliférátifs, hyperplasiques ou tumoraux."

Neuro-ergonology is the study of the neuro-ergonal regulatory system, which includes the nervous system; endogenous ergones ranging from genes and embryonic hormones to specific hormones, cythormones, and essential metabolites; exogenous ergones such as vitamins and essential trace elements; essential nutrients such as amino acids; physical regulatory factors, such as radiation, air vibrations, and gravitation; and psychosocial factors. In this context the author's philosophy seems to add up to the conclusion: An organism is an *organism*.

BENTLEY GLASS

CONTRIBUTION À L' ÉTUDE DU SYNDROME ENDOCRINIEN PROVOQUÉ PAR L'IRRADIATION TOTALE DE L'ORGANISME. *By E. H. Betz; preface by Robert Courrier. Masson & Cie., Paris.* 2,800 fr. (paper). viii + 326 pp.; ill. 1956.

The reaction of the body to ionizing radiations is being studied today in many countries for practical as well as for academic reasons. In Belgium, E. H. Betz has investigated the effects of total body irradiation on the endocrine system for a number of years. He has now assembled the results in an excellent monograph reviewing both the literature and his own extensive experiments. He has used both chemical and histological methods in his work and has restricted his investigations to the adrenal cortex, the thyroid gland, and the gonads. The theoretical speculations of the author are interesting, but the well-documented account of the author's experiments on rats is the most valuable part of the book. More than 70 excellent microphotographs show the essential features of the experiments. Two of the most interesting results of this work are the following: Total body irradiation with x-rays with a lethal dose of 800 r stimulates the adrenal cortex but inhibits the thyroid gland. However, a sublethal dose of 500 r stimulates both the adrenal cortex and the thyroid gland.

The print and general format of the book are excellent. Because of its specialized nature it will appeal mostly to research workers interested in radiobiology and endocrinology.

WALTER FLEISCHMANN

THE TECHNIQUE AND SIGNIFICANCE OF OESTROGEN DETERMINATIONS. *Memoirs of the Society for Endocrinology, No. 3. Proceedings of a conference held jointly by the Society of Endocrinological Section of the Royal Society of Medicine, at the Royal Society of Medicine, London, on 17 February, 1954.*

Edited on behalf of the Society for Endocrinology by P. Eckstein and S. Zuckerman. Cambridge University Press, New York. $3.75. vi + 96 pp.; ill. 1955.

In this symposium 8 papers were presented. Together with subsequent discussions and the general discussion at the end of each of the 2 sessions, they are printed here, as follows: A new method for the determination of oestrogens in urine and its application to a study of the oestrogen excretion in the menstrual cycle (J. B. Brown); Sources of error in the chemical determination of urinary oestrogens (W. S. Bauld); Some factors influencing the composition of urinary oestrogen fractions (R. J. Boscott); Experiences with oestrogen determination by fluorimetry after separation by partition chromatography (H. Braunsberg, M. I. Stern, and G. I. M. Swyer); Characterization of the oestrogens in human semen by countercurrent distribution and fluorimetric analysis (E. Diczfalusy); The estimation, recovery and normal levels of oestradiol in human full term placentae (F. L. Mitchell); The biological assay of oestrone and oestradiol in urine (P. M. Harlow, M. Sandiford, and M. E. Wood); and The value of oestrogen determinations to the clinician (P. M. F. Bishop). A striking change in this field over the past few years has been the shift from bioassay methods to chemical methods, as A. S. Parkes brought out. The demonstration of estrogens in human semen is particularly interesting, and like the presence of high concentrations of estrogens in the human placenta, raises the question of the functional significance, if any, of estrogens in such places.

GESTATION. *Transactions of the Second Conference, March 8, 9, and 10, 1955, Princeton, N. J.*

Edited by Claude A. Villee. Josiah Macy, Jr. Foundation, New York. $3.00. 262 pp. + 1 pl.; text ill. 1956.

COLD INJURY. *Transactions of the Third Conference, February 22, 23, 24, and 25, 1954, Fort Churchill, Manitoba, Canada.*

Edited by M. Irene Ferrer. Josiah Macy, Jr. Foundation, New York. $4.50. 226 pp. + 2 pl.; text ill. 1955.

I am not certain that the publication of round table discussions is of value or that the reader, particularly if he is a specialist in the field, can gather from them any data new to him, since most of the material presented at such meetings generally has been published

elsewhere already. Furthermore, the interruptions by participants at meetings such as those held by the Josiah Macy, Jr. Foundation often make it difficult for a speaker to develop a theme and for the reader to follow the thread of thought. While such interruptions are the meat and the value of discussion groups, they tend to destroy continuity in the recorded transactions unless diligently edited. The present two monographs illustrate these points.

The Gestation conference held in 1955 had seven sessions, with Richter leading the discussion of Self-Regulatory Functions during Gestation and Lactation; Karli, that of Social Reactions of Pregnant and Lactating Rats; Enders, Delayed Implantation in Mammals; Boyd and Burwell, Uteroplacental Circulation; Reynolds, Pressures in the Fetal Circulatory System of the Sheep; and Ramsey, the Distribution of Arteries and Veins in the Mammalian Placenta.

The 1954 conference on Cold Injury was concerned with the Interrelationship of Circulatory and Metabolic Factors (discussion led by Carlson); Metabolic Studies of the Eskimo (led by Brown and Coffey); Fat Distribution and Respiratory Quotient (by Page); Diet and Survival (by Stevenson); and the Roles of Ascorbic Acid and Subcutaneous Fat in the Prevention of Cold Injury in Man (by LeBlanc).

DAVID B. TYLER

CARDIOLIPIN ANTIGENS. *Preparation and Chemical and Serological Control. WHO monogr. Ser. No. 6. By Mary Pangborn, J. O. Almeida, F. Maltaner, A. M. Silverstein, and W. R. Thompson. World Health Organization, Geneva; [Columbia University Press, New York].* $1.25 (paper). 52 pp. 1955.
This monograph summarizes a great deal of the work of Mary Pangborn and her associates on cardiolipin antigens and describes in fair detail the preparations, the chemical and serological examination, and the control of these antigens. It undoubtedly should be in the libraries of all hospital clinical laboratories concerned with serological tests for treponematoses.

DAVID B. TYLER

ANIMAL NUTRITION

RESEARCH ON THE SCIENCE AND TECHNOLOGY OF FOOD PRESERVATION BY IONIZING RADIATIONS. *By R. S. Hannan. Chemical Publishing Company, New York.* $4.50. viii + 192 pp.; ill. 1956.
The ready availability of radiation sources having a high output of energy has made feasible their use for the preservation of food. Difficulties, not the least of which is the adequate training and protection of workers, are still to be overcome if invasion by processors into this area of food handling is to be made commercially practical. Where high doses, that is, millions of *rep*, are used, flavor and texture changes are likely to make radiation of little value in the preservation of foods; and medium doses, up to a million *rep*, are useful only when employed in conjunction with other storage and processing techniques. Low doses, of 10^5 *rep* and less, on the other hand, cause little change in flavor or texture, delay ripening of fruits and sprouting of potatoes, and can eliminate insects from stored products. It is possible also to reduce the number of microorganisms, and thus to store cut meats for a longer time.

The various aspects of radiation sources, measurement, protection, and effects are also considered in this volume. The present treatment of these topics is technically sound, and the volume should prove to be at least a useful starting-point for persons interested in entering this area of radiation biology.

C. P. SWANSON

FOUNDATIONS OF NUTRITION. *Fifth Edition. By Clara Mae Taylor, Grace MacLeod, and the late Mary Swartz Rose. The Macmillan Company, New York.* $6.00. xii + 620 pp. + 1 pl.; text ill. 1956.
This volume, the 5th edition of a textbook that first appeared in 1927, is primarily a descriptive treatise concerning the various nutrients which have been shown to be important in animal and human nutrition. The authors also give a comprehensive description of basal metabolism and of factors affecting it, of energy requirements of adults and children, of food as a source of energy, and of food in relation to growth and weight control.

Protein, mineral, and vitamin nutrition are each discussed in terms of the essentiality of the nutrient; of food sources of the item; and of the quantitative requirement, usually given in terms of the recommended daily dietary allowance suggested by the Food and Nutrition Board of the National Research Council. Good descriptions and illustrations of vitamin deficiencies in humans and experimental animals are given; but little or no information is given on the functioning of the minerals, vitamins, etc. Numerous data are presented in regard to the contribution to the diet of various types of foods, such as milk and eggs. Ninety-four pages of the volume are devoted to tables of the nutritive values of foods.

The book, which was written for individuals having no specialized training in those natural sciences upon which the science of nutrition rests, adequately meets the needs of that group of readers.

R. VAN REEN

ANIMAL NUTRITION. *Fourth Edition. McGraw-Hill Publications in Agricultural Science.*

By Leonard A. Maynard and John K. Loosli. McGraw-Hill Book Company, New York, Toronto, and London. $7.50. viii + 484 pp.; ill. 1956.

This volume on animal nutrition retains the general features of the previous editions (3rd edition: *Q.R.B.* 27: 227. 1952) in which the basic principles of nutrition are well integrated with their application to the practical problems of animal husbandry. Approximately one-half of the text is devoted to discussions of the roles of carbohydrates, lipids, proteins, minerals, and vitamins in nutrition. The latter part of the volume covers feeding experiments, nutritional balances, feeding standards, and extensive discussions of the nutritive requirements for the processes of growth, reproduction, lactation, and work.

New features in the text include a chapter on antibiotics, hormones, and other growth-stimulating substances, and an appendix containing tables of nutritional requirements of swine, dairy cattle, beef cattle, sheep, and poultry. An additional feature for instructors is a "visual aids" bibliography which lists motion pictures and film strips that can be used to supplement the book.

R. VAN REEN

APPLIED ANIMAL NUTRITION. *The Use of Feedstuff in the Formulation of Livestock Rations. A Series of College Texts in Agricultural Science.*

By E. W. Crampton; drawings by Evan L. Gillespie. W. H. Freeman & Co., San Francisco. $6.50. xx + 458 pp.; ill. 1956.

During the past few decades, a considerable amount of data has been accumulated in regard to the functions of the various metabolites and the effects produced by an absence or deficiency of the essential nutrients. As Crampton points out, however, there is a large gap between this information and the problem of practical livestock management. To bridge this gap is the avowed purpose of the present text. Such a challenging purpose is indeed pursued; but it is not altogether achieved.

The book is divided into four sections, the first of which is devoted to the definition of terms used in nutrition, to the analysis of feeds, to the energy and protein values of feeds, and to the digestible nutrients. The second section covers the energy, protein, mineral, and vitamin requirements of animals; the use of antibiotics; and feeding standards. Section three is devoted to the main characteristics of common feeds in regard to roughage, protein, etc. The fourth section reviews ration formulation and offers precise suggestions for dairy cows, beef cattle, and other domestic animals. An appendix includes feeding guides, feedstuff control in Canada, and tables of feed composition and conversion charts.

R. VAN REEN

ESSENTIALS OF NUTRITION. *Fourth Edition.*

By Henry C. Sherman and Caroline Sherman Lanford. The Macmillan Company, New York. $4.90. xii + 505 pp.; ill. 1957.

The purpose of this book is to present the basic concepts of nutrition to readers having no previous training in science. Of necessity, the presentation is highly descriptive. Each chapter, however, is followed by suggestions for further reading, so that ready references are provided for students who do have some background in science. Since exercises are also included, the presentation is adequate as a textbook.

The subject matter of each chapter has been revised from the earlier editions (3rd edition: *Q.R.B.* 27: 226. 1952) in order to include findings of the past five years. The contents apply principally to human nutrition, data on animal experimentation being used as supplementary information.

R. VAN REEN

BODY MEASUREMENTS AND HUMAN NUTRITION.

Edited by Josef Brožek. Wayne University Press, Detroit. $3.50. viii + 167 pp.; ill. 1956.

"Nutritional anthropometry" is defined by the editor of this book as the use of body measurements to characterize man's nutritional status, with emphasis on his body composition. This volume is compiled from 12 papers on nutritional anthropometry that were delivered at a conference at Harvard University in 1955.

Recommendations for the use of certain measurements such as body weight, body dimensions, adipose tissue as measured by skinfold, and muscular tissue as measured by upper arm circumference are discussed in the first chapter. Subsequent chapters discuss the use of these recordings to assess the nutritional status of adult men, 25-year-old army men, adult women, and infants. Other papers deal with the Canadian weight-height survey, life insurance records, and obesity and disease. Concerning the latter, the correlation of obesity as measured by actual weight, standard height-weight, or width-weight with heart disease is particularly interesting. The fact that the skinfold-thickness measurement, which primarily measures body fat, showed no direct relationship to the prevalence of heart disease affords cause for further study. The volume, which is well documented with references and data, should be of particular interest to nutritionists, clinicians, and anthropologists.

R. VAN REEN

A STUDY OF TWO LEVELS OF BREAD ENRICHMENT IN CHILDREN'S DIETS. *Monogr. Soc. Res. Child Developm., Vol. XVIII, Ser. No. 57, No. 2. 1953. By Pauline Berry Mack, Alice Knapper Milsom, and Paul L. Carney. Child Development Publications, Champaign.* $2.00 (paper). ii + 92 pp.; ill. 1955.

BIOPHYSICS AND GENERAL PHYSIOLOGY

CELL PHYSIOLOGY.

By Arthur C. Giese. W. B. Saunders Co., Philadelphia and London. $10.00. xviii + 534 pp. + 1 pl.; text ill. 1957.

The subject is developed as a one-quarter course for junior or senior biology majors without previous training in physical chemistry. Perhaps a fourth of the treatment is then devoted to the necessary background which cannot be thoroughly developed. This is a very serious burden, and one that is not happily solved, the developments being rather sketchy.

The many aspects of cellular functions are treated in 6 sections of several chapters each. These sections are: The nature of the cell and photoplasm; exchange of materials across the cell membrane; nutrition; irritability and response; protoplasmic growth and cell division; and history of cell physiology. Pertinent general references and specific literature citations are given for each chapter.

The erudition of the author is fully evident, but the topics are so numerous and diverse as to lead to overdiffuseness for a presentation to undergraduate students. A compromise might have been to omit treatment of several topics, such as bioluminescence and the more elaborate aspects of biochemistry (which can only be treated as a separate course), in order more fully to develop a limited and basic part of the subject. With increased complexity of knowledge, one must retreat more to thorough handling of fundamentals and not be entrapped by the desire to give a little exposure to everything.

The illustrations are excellent, and the tabular material is succinct. Thoughtfulness is evident at every point. The book serves its purpose well, since in class deletions and elaborations can readily overcome the drawbacks.

STERLING B. HENDRICKS

IONIZING RADIATION AND THE CELL. *Ann. N. Y. Acad. Sci., Vol. 59, Art 4.*

Edited by Roy Waldo Miner; conference chairman, Leslie F. Nims, 22 contributors; consulting editor, Leslie F. Nims. New York Academy of Sciences, New York. $4.00 (paper). Pp. 467–664; ill. 1955.

There are rather numerous publications dealing with the effects of ionizing radiations on living cells, and the present volume can be looked upon as a progress report on the status of radiobiology up to April, 1954. It differs little from the plan and scope of previous or more recent volumes in that it covers physical methods; chemical, viral, bacterial, and cellular studies; comparisons of the effects of different ionizing radiations; and modifications of effects by various pre- and post-treatments. The volume does, however, contain a substantial amount of data, and it is well referenced, so as to make it an essential part of the literature on radiobiology.

AN INTRODUCTION TO CELL AND TISSUE CULTURE. *Sponsored by the National Cancer Inst., U. S. Publ. Health Serv., the Mary Imogene Bassett Hospital, and the Tissue Culture Ass.*

The Resident Staff: John H. Hanks, Don W. Fawcett, William F. Scherer, Joseph Leighton, and Keith R. Porter; contributors from the Visiting Staff, Esther Carpenter, and Wilton R. Earle. Burgess Publishing Company, Minneapolis. $4.00 (paper). ix + 123 pp. 1955.

This volume represents an attempt, to quote the Preface, "to summarize the procedures and concepts which came to comprise an area of fairly general agreement in the Course given at the Mary Imogene Bassett Hospital, Cooperstown, New York, during the years 1949–1953." It succeeds in being a remarkably clear and concise summary. It is divided into three major sections: an admirable working guide to practical methods, equipment, and media for cell and tissue culture; the texts of a valuable series of lectures on the principles of cell and tissue culture; and two lectures on the application of cell and tissue culture to the fields of virology and of cancer biology. There is also an appendix which gives specific information about the Tissue Culture Course at Cooperstown, including a guide to the sources of special supplies and equipment and which will be found very useful by beginners in the field.

As the authors intended, this volume is very suitable for use as the major textbook in a beginning course in cell and tissue culture methods. It is equally valuable, however, to the beginner who cannot or does not attend such a course, and needs practical instruction. It is unfortunate that this volume has not yet been revised to include some of the most recent developments in cell culture, especially the techniques which make it possible to handle mammalian cells just as microorganisms are handled for genetic and nutritional studies. Such revision will, no doubt, be made in the near future, and will make the volume even more useful than it is now.

MICHAEL A. BENDER

CYBERNETICS. *Circular Causal and Feedback Mechanisms in Biological and Social Systems. Transactions of the Tenth Conference, April 22, 23, and 24, 1953, Princeton, N. J.*

Edited by Heinz Von Foerster; assistant editors, Margaret Mead and Hans Lukas Teuber. Josiah Macy, Jr. Foundation, New York. $2.75. 100 pp.; ill. 1955.

This book, the record of the 10th conference on Cybernetics sponsored by the Josiah Macy, Jr. Foundation, is, according to the introductory statement by Frank Fremont-Smith, "an experiment in communication, still in progress." One is tempted to use the expression made famous by a New Yorker cartoon—"Well, back to the old drawing board." It should be hastily pointed out that this particular experiment in communication was not intended primarily for readers, but for the participants in the conference, and it should therefore not be judged by the lack of resonance it invokes in this reviewer.

The primary objection to this book is that several of the contributors apparently took pains to keep the contents secret, first by using the specialized jargon of the field of information theory and thereafter by including a liberal sprinkling of Latin phrases and words. One reads:

> "Let me then give you immediately what seems to Dr. Carnap and me to be a reasonable explicatum for the presystematic concept of information, in its semantical sense. We call it content and denote it by "Cont," with a capital "C." According to the scholastic dictum, *omnis determinatio est negatio*, we take the content of a statement to be the class of those possible states of the universe which are excluded by this statement, that is, the class of those states whose being the case is incompatible with the truth of the statement.
>
> For technical reasons, however, we prefer to talk about state-descriptions instead of states. The final definition for the content of a statement is, consequently, the class of all state-descriptions excluded by this statement. One of the advantages of the shift to state descriptions is that this forces us to relativize our treatment with respect to given languages . . ." (p. 34).

Two of the papers in this volume appear quite useful. The first, Studies on Activity of the Brain, by W. Grey-Walter, describes an interesting piece of apparatus with which patterns of electrical disturbances in the brain can be displayed on a series of cathode-ray oscillograph tubes. The ingenious nature of this machine is that it sorts out "noise" from organized patterns of activity. Twenty-two cathode-ray oscillograph tubes are controlled by the electrical activity of the respective cortical areas they monitor. The oscillograph tracing is bright during activity, dark in its absence. In order that events related to each other may be observed, the scan consists of a clock-like sweep like that used in radar. All the tubes are synchronized in this sweep, but the initiation of the sweep is controlled by a given area of the brain that is chosen as a pacemaker. The pattern produced by these oscillographs is integrated photographically. The resultant picture represents repetitive events causally (temporally) related to each other. Grey-Walter noted some interesting behavior of these patterns under different conditions of external stimulation. He found that a pattern appearing first in one area reappeared in another, and then another. When a new stimulus was applied, there might be a cessation of the old pattern and development of a new series of cycles. If the same stimulus was repeated a number of times, the response would become inhibited, only to reappear with some change in the stimulus.

The other paper which seems particularly useful is Appendix I: Summary of the Points of Agreement Reached in the Previous Nine Conferences on Cybernetics, by Warren McCulloch. As its title indicates, this is a reasonably concise statement of a number of definitions and opinions concerning the resemblance of electronic relays, feed-back circuits, and amplifiers to biological and psychological devices. One forms the impression that here, as in most of modern science, the communication of ideas is hampered not so much by the difficulty of the basic concepts of the special branches as by the sometimes accidental, sometimes deliberate, stumbling-blocks (in the form of specialized terminology) put into the path of the novice by those who refuse to express commonplace ideas or concepts in language intelligible to the outsider. It is certainly true that symbols (special words or signs for special ideas) simplify the problems of communication if both the sender and the receiver know how to decode the signs. But, more and more, it becomes impossible to keep up with the basic vocabulary. And this seems too high a price to pay for the privilege of shorthand.

BERNARD L. STREHLER

DIE MAKROMOLECULARE CHEMIE UND IHRE BEDEUTUNG FÜR DIE PROTOPLASMAFORSCHUNG. *Protoplasmatologia, Band I, 1.*

By Hermann and Magda Staudinger. Springer-Verlag, Wien. DM 19.50; $4.65 (paper). 73 pp.; ill. 1954.

This is the introductory essay to the entire series of reviews and monographs making up the "handbook" of protoplasm research. It is to be accompanied in the section entitled Grundlagen by an essay by De Jong and Booij on coacervates and related systems and a third, by Zeiger, on the physical-chemical bases of cytological fixation and staining.

Unquestionably the comments on this subject of such world-famous chemists as the Staudingers will lead many to the library to read what they have to say. At a cost of more than 6 cents per page, there will be fewer individual purchasers than there are types of macromolecules which biochemists are now

able to synthesize. To be sure, it is possible for subscribers to *Protoplasma* to get these portions of the handbook at a reduced price, prior to publication—but that is also a costly business, and not without risk of disappointment. The Springer policy, which is also that of certain other Continental publishers, of charging a price high enough to recover the costs of production even if institutional libraries are the only purchasers, is nice for the publisher. It is no way to encourage the dissemination of scientific knowledge as widely as possible. Many scientists hoped that after the war this practice would cease. Instead, it seems to be spreading, and the only way to curb it would appear to be a general refusal by reputable scientists to contribute to such publications.

BENTLEY GLASS

THE ENZYMOLOGY OF THE CELL SURFACE; TENSION AT THE CELL SURFACE. *Protoplasmatologia, Band II, E 4 and E 5.*

By Aser Rothstein and E. Newton Harvey, respectively. Springer-Verlag, Wien. DM 28.—; $6.70 (paper). 86 + 30 pp.; ill. 1954.

These two reviews fit into the division of *Protoplasmatologia* concerned with the surface properties and constitution of the cytoplasm. Rothstein first considers the methods of localizing enzymes on the surface of the cell, and the definition of the "cell surface." He then groups the surface enzymes into four categories: those which chemically alter substances in the medium, those concerned with the movements of substances into and out of the cell, those which synthesize extracellular substances, and those which maintain and synthesize the cell surface structure itself. Far more can be said about the first two of these categories than about the two last. Harvey's review is devoted mainly to six methods of measuring tension at the cell surface.

Taken together, these reviews constitute a valuable addition to the handbook. The price, even for these days, is exorbitant, as seems to be characteristic of the Springer scientific publications.

BENTLEY GLASS

BIOCHEMISTRY

TEXTBOOK OF BIOPHYSICAL CHEMISTRY. *Second Edition.*

By Edward Staunton West. The Macmillan Company, New York. $7.00. xi + 399 pp.; ill. 1956.

The first half of this book contains essentially the same material as that in the first edition, published in 1942. The subject matter, which has been brought up to date, covers the conventional topics in physical chemistry: atomic structure and valence; gases and solutions; electrolyte dissociation and the mass law; acids, bases, and buffers; osmotic pressure; and the colloidal state and membrane phenomena. The background and needs of the medical student and the biology major are kept in mind in these discussions. The mathematics involved is not difficult, and numerous problems and examples elucidate the presentation.

The second half of the book treats in considerable detail a number of biochemical and physiological phenomena and demonstrates how physical and chemical principles can be used in studying these phenomena. Topics discussed are: chemistry of respiration, acid-base balance, and electrolyte and water balance; biological oxidation and reduction; organic phosphates in metabolism—chemical energetics; energy metabolism; and the velocity of reactions. This portion of the book is extremely useful, since it gives the student specific examples of biochemical data that can be approached from the standpoint of physical chemistry.

G. R. NOGGLE

A SYMPOSIUM ON INORGANIC NITROGEN METABOLISM. *Function of Metallo-Flavoproteins. Sponsored by The McCollum-Pratt Institute of The Johns Hopkins University.*

Edited by William D. McElroy and Bentley Glass. The Johns Hopkins Press, Baltimore. xiv + 728 pp.; ill. 1956.

All students of biology are familiar with the term "nitrogen cycle," but though much is known of the physiological properties of the organisms which ensure the continuation of the cycle, many details have still to be discovered about the processes which are known by such deceptively simple names as nitrogen fixation, nitrification, and denitrification. In the words of one of the contributors, we have now started to find out "how it is done," whereas previously we were looking for "what is done," and the collected papers of this symposium on Inorganic Nitrogen Metabolism held in 1955 at the Johns Hopkins University provide a stimulating guide to the present position. There are six sections dealing with (1) molybdenum and plant nutrition, (2) nitrate reduction in plants and animals, (3) nitrification and denitrification, (4) nitrogen fixation, (5) comparative aspects of ammonia metabolism, and (6) the function of metallo-flavoproteins. The concluding seventh section is a comprehensive summary of the facts and theories presented in the preceding papers. The discussions at the symposium are also included and provide valuable sidelights on aspects which many of us treat in an ostrich-like manner, e.g., how is one to define "an intermediate"?

Some thirty years ago, nutritional studies implicated

molybdenum in the mechanism of nitrogen fixation. Today there is evidence that this metal ion is often associated with flavins and is a cofactor in various enzyme systems, and it is therefore relevant that many of the papers deal with the role of molybdenum in the metabolism of all types of organisms. Hence the subtitle of the symposium, The Function of Metalloflavoproteins.

The individual papers contain a wealth of experimental facts; graphs and tables abound. The utilization of nitrate as a source of nitrogen and as a hydrogen acceptor is treated in great detail. Evidence is presented that the reactions for these two functions may not proceed by the same pathway. Much attention is given to intermediates both in nitrogen fixation and in the metabolism of nitrate, and the attempts which have been made to decide whether such compounds as hydroxylamine, nitrous oxide, nitric oxide, hyponitrous acid, nitroxyl, and nitramide are in fact true intermediates or are produced only by aberrant metabolic systems. After years of frustration, the preparation of cell-free extracts which can fix molecular nitrogen is evidently a feasible proposition, and it is to be expected that great advances will soon be made in our knowledge of the mechanism of nitrogen fixation.

Research workers in the fields of inorganic nitrogen metabolism and terminal pathways of respiration, as well as all those who teach microbiology and biochemistry, will find this volume a most useful source of detailed information.

B. A. FRY

ADVANCES IN PROTEIN CHEMISTRY. *Volume X.* *Edited by M. L. Anson, Kenneth Bailey, and John T. Edsall. Academic Press, New York.* $9.00. vii + 425 pp.; ill. 1955.

ADVANCES IN PROTEIN CHEMISTRY. *Volume XI.* *Edited by M. L. Anson, Kenneth Bailey, and John T. Edsall. Academic Press, New York.* $12.00. x + 665 pp.; ill. 1956.

These two volumes represent the latest additions to the series which has come to be regarded as a standard reference work for all those who are studying proteins and other biological materials. In Volume X, one chapter (by Lionel A. Walford and Charles G. Wilber) is concerned with the sea as a potential source of protein food. This authoritative review of all protein material found in the sea will be of interest to nutritionists, biologists, and others concerned with the future food supply of the world. Another chapter (by G. Hamoir) is concerned with fish proteins. It deals, for the most part, with muscle proteins, but a discussion of the comparative biochemistry of fish proteins is included. Other chapters are: Zinc and Metalloenzymes (Bert L. Vallee); The Nature of Phosphorus Linkages in Phosphoproteins (Gertrude E. Perlmann); Metabolism of the Aromatic Amino Acids (C. E. Dalgliesh); and Hydrogen Ion Equilibria in Native and Denatured Proteins (Jacinto Steinhardt and Ethel M. Zaiser).

Volume XI contains three chapters on methods used by protein chemists: Column Chromatography (Stanford Moore and William H. Stein); Countercurrent Distribution (P. von Tavel and R. Signer); and Measurement and Interpretation of Diffusion Coefficients (Louis J. Gosting). In addition to a description of methods, these chapters include a report of the results obtained from their application to peptides and proteins. Complex Formation between Metallic Cations and Proteins, Peptides, and Amino Acids is reviewed by Frank R. N. Gurd and Philip E. Wilcox. Part I of Hormones of the Anterior Pituitary Gland reviews the chemistry, structure, and biological activity of the growth and adrenocorticotropic hormones (Choh Hao Li). An interesting section of this chapter examines the problem of whether the integrity of the protein molecule is essential for hormonal activity. The chapter, Protein Structure in Relation to Function and Biosynthesis (Christian B. Anfinsen and Robert R. Redfield), reviews the various methods for determining amino acid sequences in proteins and gives the structures of individual proteins. The relationship between biological activity and alternation of the protein molecule (e.g., by denaturation) is reviewed with particular reference to ribonuclease. A short section on the evolutionary aspects of protein biosynthesis should be of great interest to those concerned with biochemical evolution. These volumes continue to maintain the high standards set by previous issues in the series.

LEOPOLD MAY

CHEMISTRY AND PHYSIOLOGY OF MITOCHONDRIA AND MICROSOMES. *Protoplasmatologia, Band III, A 4. By Olov Lindberg and Lars Ernster. Springer-Verlag, Wien.* DM 34.—; $8.10 (paper). iv + 136 pp.; ill. 1954.

The two authors, from the Wenner-Gren's Institute of Stockholm, here present the most comprehensive general consideration at present available of the biochemistry and physiology of the formed cytoplasmic elements included under the names "mitochondria" and "microsomes." The main sections of the review comprise a Short Survey of Methods and Morphology, and discussions of the Chemical Constitution of Microsomes and Mitochondria, Enzymic Processes Concerned in the Physiological Function of Mitochondria, and the Physiology of Cytoplasmic Particles.

As might be expected from the date of publication, most attention is given by the authors to the biochemistry of the mitochondria, which, with their enzymes for catalyzing the Krebs cycle, coupling

oxidation and phosphorylation, and forming adenosine triphosphate, have rapidly assumed a major place in the biochemical schemes of cellular metabolism. Less attention is devoted to the secretory functions of the mitochondria, which were only beginning to be explored at the time of writing. Regarding the microsomes, too, little could be said beyond a mention of their high content of RNA and their relation to protein synthesis.

The relation of the submicroscopic structure of the mitochondria and the relation of the microsomes to the endoplasmic reticulum can even now be related only vaguely to the biochemical and physiological functions known to reside in these elements. Ten years hence, we may hope, the picture will be clearer; meanwhile, great credit must be given to Lindberg and Ernster for their comprehensive summary and critique of the biochemical and physiological investigations of the formed elements of the cytoplasm.

BENTLEY GLASS

PRAKTISCHER LEITFADEN DURCH DIE BIOCHEMIE DES FLEISCHES.

By N. S. Drosdow. Akademie Verlag, Berlin. DM 28.50. xvi + 296 pp.; ill. 1954.

This volume, a series of laboratory exercises for the training of advanced students in biochemistry, should not be overlooked for several reasons. Chief among these, for all those who are concerned with the appraisal of the advancement of Russian science, is the fact that it is a translation from the Russian and represents the course of training given in Moscow to students in the Chemical-Technological Institute for the Meat Industry. Its title too effectively conceals the fact that it is by no means a technological handbook but rather a sound and extensive guide to a general biochemical training. Eight principal sections treat respectively The General Chemical Composition of the Organism, Hydrogen Ion Concentration and the Buffer Systems of the Organism, Enzymes, Carbohydrates, Lipoids and Fats, Proteins, Vitamins, and the Chemistry of Muscle (Meat). A total of 180 exercises is provided—more than enough for a course of several years' duration, it would seem. The chief defects appear to be the slightness of treatment of the nucleotides and nucleic acids and the omission of the entire group of B vitamins.

It is especially interesting that, according to this work, the development of muscle chemistry appears to have been entirely a product of Russian scientists. Even the brief mention of the decomposition of actomyosin through the action of salt and adenosine triphosphate (ATP) is unaccompanied by reference to the work of Szent-Györgyi.

BENTLEY GLASS

THE FLAVONOIDS IN BIOLOGY AND MEDICINE. *A Critical Review.*

By Maurice E. Shils and Robert S. Goodhart. National Vitamin Foundation, New York. $2.00 (paper). vi + 101 pp.; ill. 1956.

Evidence for and against a nutritional or clinical role for the flavonoid substances is presented in a straightforward and objective manner in this critical review. Beginning with the early observations of Szent-Györgyi on flavonoids in animal nutrition, considerable data concerning this group of compounds and their relationship to ascorbic acid are discussed. The authors conclude that there is no convincing evidence that these substances play a nutritional role. They suggest, furthermore, that clinical studies to date do not give adequate insight into the clinical value of flavonoids.

A brief historical coverage of the subject opens the volume. The following section deals with the chemistry of the flavonoid compounds. The remaining two parts are devoted to investigations employing experimental animals and clinical studies.

R. VAN REEN

FUNDAMENTALS OF CHROMATOGRAPHY. *Technique of Organic Chemistry, Vol. X.*

By Harold Gomes Cassidy. Interscience Publishers, New York. $9.75. xvii + 447 pp.; ill. 1957.

During the early years of its development, chromatography was largely an art. Most of the several thousand publications during this period resulted from trial-and-error attempts to separate various chemical mixtures. It was obvious, however, that chromatographic practices could not violate known physical and chemical concepts and that some rational approach should be made to the separation process. In *Fundamentals of Chromatography*, H. G. Cassidy has laid the foundation for a science of chromatography. By the careful selection of published chromatographic separations, the author shows that chromatographic phenomena have reasonable explanations. Furthermore, these explanations afford the investigator a good chance of success in selecting the appropriate chromatographic method for any particular separation problem.

The first several chapters introduce the subject matter and develop a general theory of chromatography. There follow chapters on gas-liquid partition chromatography, column partition chromatography, paper partition chromatography, absorption chromatography, ion exchange, electron exchange polymers, and foam and emulsion fractionation. For each method the principle of the separation is given, as well as the apparatus and materials needed for it. Numerous examples of actual separations are included, and the factors affecting the separation are discussed. There is also a list of methods for recognizing and evaluating

zones developed during chromatography. Another chapter discusses the relation between molecular structure and the migration values of various compounds. The two final chapters are especially valuable to the beginner, since they outline the steps necessary to develop a satisfactory chromatographic procedure. An appendix contains a source list of suppliers of chromatographic equipment. A good subject index concludes the book.

G. R. NOGGLE

VAPOUR PHASE CHROMATOGRAPHY. *Proceedings of the Symposium Sponsored by the Hydrocarbon Research Group of the Institute of Petroleum, London, May 30–June 1, 1956.*

Edited by D. H. Desty. Academic Press, New York; Butterworths Scientific Publications, London. $12.00. xv + 436 pp.; ill. 1957.

This book contains 36 papers presented at a symposium held last summer in London. Like other branches of chromatography, gas chromatography has developed so rapidly that there is considerable confusion in its terminology. During this symposium a committee on nomenclature was appointed, and their report is included in the volume. Among other things, it recommends that the term "Vapour Phase Chromatography" be dropped in favor of the term "Gas Chromatography."

While the title of the book may consequently be out of date, the material presented certainly is not. The book is especially timely because there has been no single good reference work on gas chromatography. The existing literature is widely scattered in numerous publications, many of them unfamiliar to the biologist. The papers in this volume cover such topics as the construction and operation of columns, the construction and use of detecting devices, the preparation of samples, the selection of inert and moving phases, as well as descriptions of actual separations. The discussions that followed each presentation are also printed, and many valuable suggestions about the practical details of chromatographic separations are reported.

From the biological viewpoint, the method of gas chromatography appears to be particularly valuable for separating fatty acids and fatty alcohols. Despite the lack of a general subject index, *Vapour Phase Chromatography* is recommended to any biologist who is looking for new methods of separating and isolating biological compounds.

G. R. NOGGLE

ORGANIC SYNTHESES. *Collective Volume 3. A Revised Edition of Annual Volumes 20–29.*

Editor-in-Chief, E. C. Horning; editorial board, C. F. H. Allen, N. L. Drake, C. S. Hamilton, R. L. Shriner, L. I. Smith, H. R. Snyder, and Norman Rabjohn. John Wiley & Sons, New York; Chapman & Hall, London. $15.00. x + 890 pp.; ill. 1955.

That this outstanding series is an indispensable reference work in the field of preparative organic chemistry is without question. This latest collective volume is a compilation of the procedures originally presented in the annual volumes 20 through 29. Besides additions to and revisions of the original procedures, new and improved procedures for the preparation of acenaphthenequinone, beta-ethoxypropionaldehyde acetal, aminoacetal, 3-amino-1H-1,2,4-triazole, mesitoic acid, alpha-tetralone, and 2-thiophenealdehyde have been included in the present volume. Furthermore, an index section on the purification and preparation of reagents and solvents has been added. This volume will surely prove to be as useful a reference as its two precursors in the collective series.

ANTHONY SAN PIETRO

THE CHEMICAL CONSTITUTION OF NATURAL FATS. *Third edition, revised.*

By T. P. Hilditch. John Wiley & Sons, New York. $16.00. x + 664 pp.; ill. 1956.

This book provides the reader with a complete view of the field of fats and fat components. Analyses of fats in terms of fatty acids are presented for aquatic flora and fauna, for animals, and for vegetables; and glyceride compositions are listed for individual animal and vegetable fats. Two chapters are devoted to the structures and syntheses of fatty acids and glycerides; and the experimenter is given, in the last chapter, the techniques used for the analysis of fat, as well as several case histories from the literature. Ample references to the literature are provided at the end of each chapter, and the author has very kindly listed separately the references to many tables, several of which in summarizing the data for a particular species have as many as 80 references. Five convenient indexes include a general subject index, as well as separate indexes for individual fats and waxes, for individual fatty acids, for individual glycerides, and for plant families. The general plan of the book remains unaltered from previous editions (2nd ed., *Q.R.B.*, 24: 72. 1949), with the exception that, where earlier volumes provided a survey of the biochemistry of fats, this one restricts itself to a discussion of the biosynthesis of fats. Retention of the original form of this chapter would have provided the reader with a more complete survey of the field.

LEOPOLD MAY

ÜBER STERINE, GALLENSÄUREN UND VERWANDTE NATURSTOFFE. *Second Edition (in 2 volumes), Volume*

1. Sammlung chemischer und chemisch-technischer Beiträge, N.F. No. 29a.

By H. Lettré, R. Tschesche, and H. Fernholz. Ferdinand Enke Verlag, Stuttgart. DM 85.—(cloth); DM 81.50 (paper). viii + 455 pp.; ill. 1954.

This is one of those thorough and authoritative treatises in which German science justly takes pride. There are 5 main sections to the work. In the first, H. Lettré discusses the chemical constitution, stereochemistry, and synthesis of the steroids and bile acids, and follows this with a consideration of steroid distribution in vertebrates, invertebrates, and the higher and lower plants. The general, if not entire, absence of steroids in bacteria may be taken to imply that these compounds are of secondary rather than primary significance in biochemical evolution. The bile acids are likewise considered in an extensive section. Lettré has also written the second section of the book, which deals with Vitamin D and the products of irradiation of the antirachitic provitamin.

In Section C, R. Tschesche treats the comparative biochemistry of the neutral saponins (spirostanol glycosides). H. Fernholz briefly covers the topic of the sterin-alkaloids (the *Solanum*, *Veratrum*, and *Holarrhena* alkaloids). In a final, lengthy section, H. Tschesche deals with the subject of the heart poisons, under the headings of the glycosides and esters with suberyl-arginine, the aglycones of the cardenolid type (digitoxigenin, etc.), and finally the determination of structure of the aglycones of the bufadienolid type, of which 8 may now be regarded as determined and 4 or 5 still uncertain in detail. Other aspects than the chemical structure, such as the physiology and pharmacology of the animal and plant heart toxins, are treated more briefly.

As a whole, the book will be an indispensable reference work for all steroid biochemists and pharmacologists. In addition, it possesses great interest and value for anyone who is interested in comparative biochemistry and biochemical evolution.

BENTLEY GLASS

LABORATORY MANUAL OF BIOCHEMISTRY. *Fourth Edition.*

By Benjamin Harrow, Ernest Borek, Abraham Mazur, Gilbert C. H. Stone, and Harry Wagreich. W. B. Saunders Company, Philadelphia and London. $3.00 (paper). vii + 164 pp.; ill. 1955.

Experiments have been added on the time course of starch hydrolysis, filter paper chromatography, the estimation of catalase, yeast fermentation, estimation of gastric acidity, the absorption spectrum of hemoglobin and related compounds, the oxygen capacity of blood, together with various additions to the quantitative estimation of urinary constituents, to certain animal experiments, and some vitamin estimations. A laboratory schedule for a 2-semester course in biochemistry, based on the authors' experience at the City College of New York, is another new feature. The general emphasis remains dictated by the classical requirements of animal and human physiology. Nucleotide and nucleic acid chemistry are represented solely by one experiment, on the preparation of ribose nucleic acid from yeast.

MICROBIOLOGY

AUX CONFINS DE LA VIE. *Perspectives sur la Biologie des Virus.*

By P. Morand. Masson & Cie., Paris. 850 fr. (paper). 171 pp. + 8 pl.; text ill. 1955.

The author's principal conclusion is that the viruses represent the lower limits of living matter, a conclusion with which few would disagree violently. In essence, the volume is an elementary consideration of the biology of viruses, including the growth, genetics, chemistry, and pathology of the major virus strains.

THE ROGER ADAMS SYMPOSIUM. *Papers Presented at a Symposium in Honor of Roger Adams at the University of Illinois, September 3 and 4, 1954.*

Six Contributors. John Wiley & Sons, New York; Chapman & Hall, London. $3.75. x + 140 pp.; ill. 1955.

The papers in this symposium commemorate Roger Adams' retirement as Chairman of the Chemistry Department of the University of Illinois. The papers are united, not by subject matter, but rather by the fact that all the authors are former students of Dr. Adams. Papers and authors alike constitute a fine and worthy tribute to an eminent chemist. Such symposia, particularly if the papers are stimulating, seem ideal mechanisms for honoring elder scientific statesmen.

After an introduction in which E. H. Volwiler briefly reviews the character, intellect, practicality, business sense, productivity (350 papers, at a rate of one per month), and general qualities of Roger Adams, the first paper, by Wallace Brode, on Steric Effects in Dyes, is presented. This is a good, searching paper that deals with some factors which influence absorption spectra. It is a useful reference article.

There follow papers by John R. Johnson and Samuel M. McElvain on some special chemical structural determinations on an antibiotic, Gliotoxin, from the wood fungus, *Gliocladium fibriatum*, and on the active principle of catnip, nepetalic acid. These two papers are not of major interest to biologists, but they are useful as examples of the systematic and logical approach to problems of chemical structure. They describe lucidly and in detail the procedures involved in a typical

structural determination; as such, they are excellent reading for those who may encounter similar problems.

Although Ralph L. Shriner's paper dealing with flavylium chemistry might be of interest to biologists who are interested in plant pigments, such as the anthocyanins, it is a highly technical paper dealing with specific minor reactions and can readily be omitted from the first reading of this book.

The last paper, Some Chemical Studies on Viruses, by Wendell M. Stanley, is a pleasant and stimulating survey of past and recent advances in virus chemistry. The style is lucid and the illustrations attractive. The thesis that viruses fall in the borderland between molecules and organisms is a hackneyed truism that might well have died with Aristotle, who is purportedly the originator of the concept that the living world shades imperceptibly into the non-living. That viruses need a special intracellular environment in order to grow or to duplicate seems to be an arbitrary basis for defining them as living or as non-living. If photosynthetic organisms were to select the criteria of livingness, they might consider us as dead since, in comparison to them, we require a rather special chemical environment.

BERNARD L. STREHLER

MANUEL TECHNIQUE D'ANALYSE MICROBIOLOGIQUE DU SOL.

By J. Pochon; with the collaboration of J. Auguer, H. de Barjac, O. Martre-Coppier, M. A. Chalvignac, and J. Lajudie. Masson & Cie., Paris. 750 fr. (paper). viii + 124 pp.; ill. 1954.

This monograph by a Chef de Service at the Institut Pasteur is a complete handbook on the methods needed to make a complete microbiological survey of a soil sample. Separate chapters treat the general techniques; the assay of the total microflora; the nitrogen-fixing organisms; the ammonifying organisms; the nitrifiers; the denitrifiers; cellulolytic organisms; amylolytic, hemicellulolytic, and other glucidolytic organisms; the biological sulfur cycle; the enumeration of actinomycetes; of fungi; of algae; and of protozoa; and a schema for the entire analysis of the soil. This monograph will be essential to the work of every soil microbiologist.

INTRODUCTION TO THE PATHOGENIC ANAEROBES. *By Louis DS. Smith. The University of Chicago Press,* Chicago. $7.50. viii + 254 pp.; ill. 1955.

The pathogenic anaerobic bacteria are all too frequently overlooked in routine bacteriological diagnostic work. This book by Smith is very much needed and is a welcome addition to any bacteriological library. He has brought together a great deal of information on these various groups, emphasizing particularly the toxins of the *Clostridia*. Over half of the book is devoted to the *Clostridia*. There are chapters on Anaerobic Methods and Media and on Anaerobic Wound Infections in Man. Many of the media suggested are made from an infusion base which is now unnecessary, time-consuming, and unreliable. The tables of the common cultural characteristics of the various groups may be useful to the extent that the media are defined and reliable. It is well established that the base medium for fermentation tests should not contain fermentable carbohydrates, and yet Smith suggests that either proteose peptone or trypticase be used for this purpose. Proteose peptone contains fermentable carbohydrates; trypticase does not. Many of the discrepancies in the cultural characteristics of bacteria reported in the literature are probably due to the use of unreliable media.

Chapters on the *Actinomyces*, *Bacteroides*, anaerobic streptococci, and fusospirochetal infections bring together valuable material and many practical points. This book is important because it brings together information that has not been previously readily available.

E. PETRAN

BACTERIAL ANATOMY. *Sixth Symposium of the Society for General Microbiology held at the Royal Institution, London, April 1956.*

Edited by E. T. C. Spooner and B. A. D. Stocker. Cambridge University Press, London; [Cambridge University Press, New York]. $6.00. x + 360 pp. + 22 pl.; text ill. 1956.

During the past 15 years, following a long period of comparative neglect, study of the bacterial cell has flourished. The initial impetus to renewed interest in the field was provided by Robinow, who was largely responsible for reintroducing the rigorous use of classical cytological methods in work on the bacteria. About the same time, the development of the electron microscope provided a new method of observation particularly valuable in the study of the bacterial cell, where the inherent physical limitation of light microscopy is a very serious one. More recently, purely observational methods have been powerfully supplemented by chemical and physiological investigations of such isolated cell-components as flagella, cell walls, and protoplasts. The analytical approach has already contributed much important information about the structure of the bacterial cell which could not have been obtained by purely observational methods. This book brings together, for the first time, the results of recent observational and analytical work on the bacterial cell. It has

the unevenness and the gaps inevitable in any volume which reports the proceedings of a symposium; but in spite of this, it constitutes by far the best available account of the subject.

Some of the contributions are general reviews; others are largely accounts of the authors' own researches. In the first category there are excellent reviews on bacterial flagella (Stocker), cell walls (Salton), and the organization of bacterial cytoplasm (Bradfield). A very interesting general discussion of osmotic function and structure in bacteria is provided by Mitchell and Moyle. The properties of protoplasts are described by Weibull and by McQuillen; both articles report much original work. Another outstanding original article is that of Hannay, who provides a full description of his fascinating investigations on the parasporal inclusions characteristic of certain bacilli, and their role in the pathogenesis of bacterial diseases of insects. Four contributions are devoted to the highly controversial and still unsettled problem of the structure of the bacterial nucleus. Robinow and Delamater, the principal protagonists in the controversy, give very full accounts of their observations and interpretations. The subject is also discussed by Maaløe and Birch-Andersen and by Elliott. Other contributions deal with capsules (Tomcsik, Thorne) and "long forms" of bacteria (Hughes). Bisset provides a characteristic introductory essay.

R. Y. Stanier

Dictionary of Microbiology.

By Morris B. Jacobs, Maurice J. Gerstein, and William G. Walter. D. Van Nostrand Company, Princeton. $6.75. 276 pp. 1957.

The need for specialized scientific dictionaries is obvious. Each science, as it grows, develops a special language, which is represented tardily and incompletely even in the largest general dictionaries. Yet, specialized lexicography is not a task to be undertaken lightly. It demands much factual and historical knowledge and a capacity for judicious selection, coupled with a gift for lucid thought and expression. The present book, which attempts to satisfy the need for a dictionary of microbiology, was undertaken by authors who lacked the necessary lexicographic qualifications and it is consequently a parody of what a scientific dictionary ought to be. Despite its title, the coverage is very incomplete; the vocabularies of protozoology, algology, and much of mycology are either unrepresented or misrepresented. Even in the fields of bacteriology and virology there are many startling omissions: one looks in vain for *lysogeny, prophage, replica plating, chemostat, inducer, auxotroph,* or *syntrophism.* On the other hand, much space has been wasted by including terms which are not strictly relevant to microbiology and which the intelligent reader can easily find in other reference books. Alcoholic beverages are covered in great detail, half a page being devoted to the whiskeys alone. Many common organic compounds are included, in most cases with rather poor descriptions. Rare or obsolete terms appear without any indication that they are not in current use. Examples of such vestigial words are: *biodyne, chemokinesis, endoplasm, symplasm,* and *symase.* Lastly, there is a fatal lack of lucidity in many of the definitions. An *Ångstrom* is defined as "a unit of length, usually considered to be 1×10^{-4} micron." *Plasmagenes* are "genetic determinants in the broadest sense." Even more remarkable is the definition of *Enzyme, Indispensable:* "An enzyme that must be synthesized by an organism in order to remain viable. It may be more than one enzyme." *Neurospora crassa* is described as: "A fungus which can synthesize tryptophan from indole and L-serine. It is used for the study of gene mutations induced by exposure of its spores to X-rays and ultraviolet light."

R. Y. Stanier

Dairy Microbiology.

By Edwin M. Foster, F. Eugene Nelson, Marvin L. Speck, Raymond N. Doetsch, and Joseph C. Olson. Prentice-Hall, Englewood Cliffs. $4.25. xvi + 492 pp.; ill. 1957.

This book is intended not only for students, but also for "sanitarians, dairy fieldmen, laboratory technicians, and others in the dairy industry." It is well written, well organized, and well printed, and the price is very reasonable. Each chapter is followed by numerous references, and the index seems comprehensive and detailed. Both the material included and the method of treatment are thoroughly up to date. As a textbook for students who have had some preliminary background in microbiology, it should be splendid. Others will find it very valuable as a reference work. Without going into a detailed analysis of the contents, I can recommend this book as an outstandingly good one.

Walter C. Tobie

PARASITOLOGY

Some Physiological Aspects and Consequences of Parasitism.

Edited by William H. Cole; contributors, Ernest Bueding, James W. Moulder, Clark P. Read, Leslie A. Stauber, William H. Taliaferro, and William Trager. Rutgers University Press, New Brunswick. $2.00 (paper). xii + 90 pp.; ill. 1955.

Resulting from a symposium at Rutgers University, this publication consists of 6 articles dealing with host

and parasite metabolic relations and is written by a distinguished group of specialists. In order of presentation these are: Studies on the Cultivation of Malarial Parasites, by William Trager; The Protein Metabolism of Intracellular Parasites, by James W. Moulder; Intestinal Physiology and the Host-Parasite Relationship, by Clark P. Read; Studies of the Glycolytic Enzymes of *Schistosoma mansoni*, by Ernest Bueding; Studies in Antibody Formation, by William H. Taliaferro; and Leishmaniasis in the Hamster, by Leslie A. Stauber.

In the introduction, Stauber remarks that a parasite, by living off its host, synthesizes new protoplasm and exerts physiological and chemical activity which obviously affects its host and elicits a counter-reaction. But except possibly for the stimulation of antibody formation, the detailed causes and effects of host-parasite interactions are all but unknown. The papers of the conference represent promising areas of significant discovery relating to such basic phenomena. It is to be noted that the topics include the results of original investigations involving parasitic protozoa and helminths, cultivation and nutrition, protein metabolism, and the specific nature of certain enzymes of parasites. The unifying theme of the papers is that of host-parasite relationships.

Discussing his successful cultivation of the avian malarial parasite *Plasmodium lophurae* on a concentrated extract of duck erythrocytes handled aseptically but not sterilized, Trager was able to carry out a series of significant experiments using such additives as adenosine triphosphate (ATP), sodium pyruvate, yeast adenylic acid, cozymase, and other substances.

Is there a comparative biochemistry of obligate intracellular parasitism? Moulder raises the question and then draws evidence from virus-bacterium systems, malarial parasite metabolism, and typhus rickettsiae, and concludes, "Although the comparative biochemistry of intracellular parasitism is in a rudimentary stage for lack of data of sufficient breadth and depth, the comparative approach to the biochemistry of these host-parasite systems is still a valuable one. It can furnish a framework into which new experimental findings may be fitted, and it can serve as a guide to areas of investigation in which results of general significance may be expected."

Read reports on the intestinal physiology of the host and its relation to the parasite. After demonstrating that the rat tapeworm *Hymenolepis diminuta* does not utilize starch directly, numbers of rats, each infected with a single tapeworm, were divided into three groups. One group was given Ringer's solution, the second was fed 0.2 *M* glucose in Ringer's solution, and the third received starch (equivalent to 0.2 *M* glucose) in Ringer's solution. After 150 minutes, the tapeworms were removed and analyzed for glycogen content. It was demonstrated that the starch diet yielded by far the greatest quantity of glycogen. It therefore appears clear that although starch is more important than the monosaccharide as a food source for the tapeworm in the host intestine, host enzymes must first break it into hexose units before such a parasite can make use of it. This type of ingenious experiment has enabled Read to give us a broader knowledge of basic host-parasite relationships. Other topics treated in his section include intestinal secretions and tapeworm excystation and establishment in the host, and morphological observations in relation to physiological findings.

Experiments and theoretical considerations also characterize the substance of the remaining reports of the symposium. The work not only is of interest on account of the information presented, but especially from the standpoint of how such information is gained from experiments. For this reason, it is recommended that reference copies be made available to students of parasitology and other advanced courses in biological science. Reading some or all of the accounts would be stimulating and give a viewpoint not always gained in some courses. Biochemists, physiologists, and other biologists will be interested in this horizon field of experimental biology.

RALPH W. MACY

SITES OF INFECTION. *Unstable Areas as Sources of Parasitic Diseases: Schistosomiasis and Fascioliasis. By Alan Mozley. H. K. Lewis & Company, London.* 9s. x + 86 pp.; ill. 1955.

The ecological approach to parasitology seems, from recent publications, to be gaining ground. A. Mozley, who is concerned chiefly with studies of flukes and schistosomes and their snail hosts, develops an interesting theory in this small book. Large, dense populations of the snails often occur in frontier areas; and Mozley suggests that it is because of the marked instability of biological communities of frontier areas, where advance, regression, and other changes take place constantly. Could one say, to carry his thought a bit farther, that snails, so to speak, are "animal weeds"?

The one common feature of the diverse places where disease-transmitting snails are abundant is their ecological instability. Control work may thus capitalize on the stabilization of natural forces so as to bring such populations into a more normal relationship with the organic community. Yet it remains likely, so Mozley thinks, that in special places like irrigation canals, where unusual conditions prevail indefinitely, it will probably be necessary to use molluscicides indefinitely, too.

BENTLEY GLASS

CONTRIBUTION À L'ÉTUDE DES PARASITES ET PHORÉTIQUES DE COLEOPTÈRES TERRESTRES. *Supplement No. 4 à "Vie et Milieu," Bulletin de Laboratoire ARAGO.*

By Jean Théodoridès. Hermann & Cie., Paris. 1600 fr. (paper). 310 pp.; ill. 1955.

This is a detailed account of the parasites and phoretic organisms discovered during the course of the examination of 169 species of beetles representing 18 families and comprising some 2000 individuals of numerous species. Probably reflecting the availability of material, the survey is unequal in emphasis, since some families are represented by a single species whereas hundreds of specimens of many species of scarabaeids, tenebrionids, and chrysomelids are listed. In view of the fact that the Curculionidae is considered to be the largest family of all animals, it is remarkable that only a single specimen of one lone species was studied.

Most of the beetles examined were obtained in the Mediterranean region, especially from the coastal region of France, but some came from north Africa, Madagascar, Iran, and elsewhere. In this project, the author had the aid of numerous specialists in various countries who cooperated to increase the authenticity of identifications of both the Coleoptera and their animal associates.

The first part of the book deals with techniques, localities, and other general matters, whereas the second part considers the morphology and taxonomy of the parasites and phoretics encountered. In the three principal families examined, about fifty per cent of the specimens were infested, and the parasites and phoretics were found to include 37 species of sporozoans, 4 species of cestodes, 36 species of nematodes, 58 species of acarines, 5 species of insects, and 6 species of fungi. Among these, a number of species are described as new.

Part Three considers hyperparasites and hyperphoretics, a list of hosts and their associates, ecology, intensity of infestation, specificity, biogeography, and significance. There is also an extensive bibliography of 22 pages.

This is an important contribution of value to parasitologists, ecologists, and entomologists. It is to be hoped that the author's study may be followed by one on aquatic beetles, since these are known to harbor larval Acanthocephala, larval Trematoda, and numerous protozoa not recorded for terrestrial species.

RALPH W. MACY

LIVER-FLUKE SNAILS IN BRITAIN.

By Alan Mozley. H. K. Lewis, London. 9s. xii + 55 pp.; ill. 1957.

The author states that since liver-fluke disease takes a heavy toll of sheep and young cattle in England, Scotland, and Wales, a simple account of the occurrence of the snail intermediate host would be useful for veterinarians, advisers, and farmers, in order that they might more easily find these essential hosts and eliminate them. Following a brief chapter on a few facts about liver-fluke disease, the agent *Fasciola hepatica* and its life cycle, and losses due to the malady, which are said to be enormous, there is a section on "How to find liver-fluke snails." Much of the thin book is an account of the author's wanderings on foot through pastures and valleys of England, Scotland, and Wales, observing the habitats of the important snail host, *Lymnaea truncatula*. No dry statistics, no complex graphs crowd the pages. The style may be typified by a quotation, thus: "Leaving the valley bottom I crossed the railway line and walked up the hill. I had a look at the ditch on each side of the railway as I passed, for, especially where a little moisture collects on a clay bottom, ditches beside railway lines may sometimes harbour *Lymnaea truncatula*. In this particular instance I found no snails."

After recounting numerous observations on the locales of the snails, the author summarizes the preferred sites. He continues in another chapter, The Flukey Places Analyzed, and finally discusses the methods of control. No determination of infection rate in the snails is mentioned, since presumably few farmers would have the means of doing this, although it would have been of much interest to parasitologists.

Information given on the ecology of this species of snail is of some interest to biologists, but farmers of the British Isles will benefit most from reading the book, and it might well be of considerable help to them in reducing liver-fluke disease.

RALPH W. MACY

HEALTH AND DISEASE

ANNUAL REVIEW OF MEDICINE. *Vol. 8.*

Edited by David A. Ryland, William Creger, and Committee. Annual Reviews, Palo Alto. $7.00. vii + 530 pp. 1957.

This book is a series of 23 reviews of topics of current interest in the field of internal medicine. Under each heading the literature of the previous year or two is discussed and analyzed in typical review form. The scope of this book clearly restricts its use to practicing internists and teachers of medicine.

F. N. LOW

1957 MEDICAL PROGRESS. *A Review of Medical Advances During 1956.*

Edited by Morris Fishbein. The Blakiston Division,

McGraw-Hill Book Co., New York, Toronto, and London. $6.00. xii + 367 pp. 1957.

The subtitle of this book of reviews sufficiently indicates its scope. The titles of the 19 sections are: Medicine, Cardiovascular Disease, Neurology, Endocrinology, Gastroenterology, General Surgery, Obstetrics, Allergy, Psychiatry, Diabetes, Rheumatic Diseases, Nutrition, Dermatology, Ophthalmology, Physical Medicine and Rehabilitation, Otolaryngology, New Drugs, Orthopedics, and Laboratory Procedures. The reviews vary somewhat in scope and quality, as well as in number of references given; but the index appears to be adequate—a feature of some importance in a work of this type. Anyone interested in a brief survey of recent advances in any of the fields named will probably find the book to be of considerable value.

WALTER C. TODIE

THE INFECTIOUS DISEASES OF DOMESTIC ANIMALS *with Special Reference to Etiology, Diagnosis, and Biologic Therapy. Comstock Series in Veterinary Medicine. Third Edition.*

By William Arthur Hagan and Dorsey William Bruner. Comstock Publishing Associates, a division of Cornell University Press, Ithaca. $10.50. xx + 968 pp. + 1 pl.; text ill. 1957.

This book, first published in 1943, has been widely adopted in North American veterinary schools. It assumes that the student is well grounded in basic principles of microbiology. The broad organization of the text is almost identical with that of the second edition (*Q.R.B.*, 29: 193. 1954). The first 9 chapters deal with the general principles of infection and resistance and with the general background of chemotherapy. The remaining chapters are concerned with the etiology, diagnosis, and control of virtually all the known infectious diseases of livestock and poultry in North America. The more important livestock diseases which occur elsewhere are also included. Modifications in the various chapters are chiefly additions of researches published since the second edition appeared in 1951. Many diseases which are of economic importance to livestock producers occur also in man. The sections which deal with tuberculosis, brucellosis, and rabies are very well done; they emphasize the close relationship between prevention and control of these diseases among domestic animals, on the one hand, and public health and safety, on the other. For most of the animal diseases described, a brief, clear-cut statement is made concerning the status of the disease for man. The final chapter describes several diseases of unknown etiology. One of these, cat scratch fever, is an ulceroglandular disease of man; another is mucosal disease of cattle, which was first described in 1955.

FREDERICK N. ANDREWS

MORBIDITY IN THE MUNICIPAL HOSPITALS OF THE CITY OF NEW YORK. *Report of an Exploratory Study in Hospital Morbidity Reporting.*

By Marta Fraenkel and Carl L. Erhardt. Russell Sage Foundation, New York. $4.50. 229 pp.; ill. 1955.

This essentially statistical report covers the period from May to October, 1952. It is broken down into various categories, such as diagnosis, sex, color, age, duration, and type of disease. Much of the material is presented in tabular form. Statistically useful, it has no application outside its special field.

F. N. LOW

TRAITÉ DE MÉDECINE BIOTYPOLOGIQUE.

Published under the direction of Nicola Pende. G. Doin & Cie., Paris. 8,850 fr. 1063 pp.; ill. 1955.

This book is a collection of about thirty essays on the different aspects of physical "biotypes" in man. After extensive sections on general concepts and methodology, the various biotypes are considered in relation to such topics as sex, changes during growth, and senescence. The essays on applied biotypology deal with its relation to disease, criminology, social factors, and the like. A bit on the esoteric side, this contribution, though earnestly conceived, will have little application outside its special field.

F. N. LOW

BLUTKRANKHEITEN, *Methodik, Klinik und Therapie.*

By Hans Fleischhacker. Wilhelm Maudrich, Wien-Bonn. DM 30.–. viii + 247 pp.; ill. 1955.

This textbook is a brief and very much condensed review of all the blood diseases now known. An initial section presents methods of preparation, enumeration, and examination of the blood. Following this, the author treats in succession the pathology of the erythropoietic, the leukopoietic, and the thrombopoietic systems; the hemorrhagic disease, and the pathology of the reticulum cells and of the plasma cells.

There is very little new material in this textbook. The illustrations are of only average clarity; and the color differentiation of the special plates is no better than we usually see in this country, in contrast to the very fine lithographing often done abroad.

Obviously the book is meant for students and for general practioners, and does not attempt to give either very new material or a comprehensive discussion of the usual blood disease. It therefore may be considered just another book in this interesting field. Although it may be of value to a large number of physicians, it is not

meant to be an authoritative or comprehensive text on any and all blood disease.

L. K. DIAMOND

LES MALADIES AVEC AUTO-ANTICORPS. *Rapports présentés au XXX^e Congrès Français de Médecine, Alger, 1955 (Ass. des. Méd. de Langue française.)*

Président du Congrès, P^r. Ed. Benahmou. Masson & Cie., Paris. 1,600 fr. (paper). iv + 283 pp.; ill. 1955.

This monograph presents a series of papers by different authors describing the diverse clinical and experimental situations in which immunological abnormalities related to the production of auto-antibodies have been incriminated. Although the introductory paper by Lemaire and Debray relates diseases of practically every organ system to auto-antibodies, there is a cautious critical summary indicating the frequently speculative nature of the relationship. The European, particularly the French scientist, has more than the American vigorously advanced the probable role of these immunological abnormalities in the pathogenesis of seemingly unrelated entities.

The bulk of the monograph, following the introductory chapter, consists of discussions of the auto-antibody and its participation in hemolytic anemia, purpura, agranulocytosis, and hemoglobinuria. The paper on immunological purpura, by Stefanini, is the only presentation by an American author, and his work is well known in this country.

The problems involved in assay of this immunological system are presented by Van Loghem, Jr., Mendes de Leon, and Van der Hart. Included are rather detailed descriptions of the serological procedures usually employed.

An extensive bibliography is appended to each paper. However, as unfortunately is so often the case, the titles of the references are not provided. Of particular importance to investigators in this country is the citation of literature primarily from Europe, sources not too often consulted in the United States.

The time required by the reviewer for separating pages of the monograph with a letter opener could have been more profitably spent reading the written material or consulting another source. However, we are accustomed to the excellence of the publication and printing of our American books and monographs, even though they are exorbitantly more expensive.

LEIGHTON CLUFF

GLAUCOMA. *Transactions of the First Conference, December 5, 6, and 7, 1955.*

Edited by Frank W. Newell. Josiah Macy, Jr. Foundation, New York. $4.50. 251 pp.; ill. 1956.

This book covers the first Macy Conference on glaucoma. Three papers on subjects pertinent to abnormally high intraocular pressure are presented. In keeping with the foundation's editorial policy, the questions and answers that occurred during the presentation are printed in the text. This report is of the high quality typical of Macy Conference Reports; but since its subject is so very restricted and primarily of clinical interest, it will have limited usefulness outside its field.

F. N. LOW

FUNCTIONAL OTOLOGY. *The Practice of Audiology. By Morris F. Heller, with Bernard M. Anderman and Ellis E. Singer. Springer Publishing Company, New York.* $5.50. xii + 225 pp.; ill. 1955.

Except for the consideration of audiometry, this treatise is almost wholly practical and clinical in point of view. It will be of little use except to clinicians, since the treatment of audiometry is too restricted and elementary to be helpful to biologists concerned with the measurement and analysis of hearing.

DIE ÜBERFUNKTION DER NEBENNIEREN. *By Rudolf Chawalla. Wilhelm Maudrich, Wien and Bonn; [Intercontinental Corporation, New York.]* DM 48.–. xii + 330 pp. 1955.

This volume consists chiefly of discussions in rather general terms of a great variety of disorders which the author thinks it profitable to relate to the functional level of the adrenals. The subject is not treated on a level which would probably be of much interest to biochemists or biologists.

EVELYN HOWARD

YOUR FEET AND THEIR CARE. *By William A. Rossi; introduction by Joseph Lelyveld. Emerson Books, New York.* $3.00. xii + 212 pp.; ill. 1955.

Written for the general public, this book, if it lives up to its promise, will make obsolete the phrase "My feet are killing me." It is a practical treatise of foot troubles, their care and correction. The author contends that 8 out of every 10 adults, and 7 out of every 10 children are foot-defective, frequencies which suggest that the evolutionary processes which produced man as an upright animal were not particularly efficient, and that the bridge to man's future is over a defective metatarsal arch.

THERAPEUTIC USE OF ARTIFICIAL RADIOISOTOPES.

Edited by Paul F. Hahn. John Wiley and Sons, New York; Chapman and Hall, London. $10.00. x + 414 pp.; ill. 1956.

The 19 papers that comprise this authoritative work come from 29 internationally recognized specialists whose fields are radiophysics and radiotherapy and who represent the United States, England, Sweden, and Switzerland. They contribute discussions of the history, the theory, and the current therapeutic principles to be observed in using a wide variety of artificially produced radioisotopes. Introductory chapters treat such topics of general interest as therapeutic radiation problems, radiological physics, radioisotope dosimetry, the availability and procurement of isotopes, and the production and handling of therapeutic isotopes; the work deals largely with the clinical application of artificial radioisotopes in the control of neoplastic disease.

One of the major problems in radioisotope therapy is that of delivering the ionizing radiation solely, or largely, to the desired body site. In view of the simplicity of method involved in the dissemination of artificially radioactive substances throughout the entire body via transfusion media (as compared with that of directing and keeping them in specific tissues), the major clinical application of them to date has been in the field of such generalized diseases as the leukemias and polycythemia vera. With the development of more exact techniques of concentrating these materials in any desired location, as well as a more complete understanding of the natural affinity of certain tissues for particular elements, their utility will be considerably broadened.

As in the case of conventional methods of radiotherapy, a concomitant problem in the use of radioactive isotopes has been the recognition and correction of a variety of undesirable indirect effects. Development of research in this area has now made it possible to combine restorative measures with radiotherapy to minimize complications. While these substances offer nothing new in terms of physiological response, and while application of them is subject to the same limitations as older procedures, advantages are to be found in the wider variety of form, energy, and adaptability of artificial radioisotopes. In terms of present usage, it may be said that as of today, the isotopes I^{131} and P^{32} are firmly established in medical practice, and that Au^{198} and Co^{60} are well on the way to a similar place in an ever-widening therapeutic armamentarium.

The papers are well documented with a profusion of tabular and illustrative materials demonstrating dosage calibrations, methods of application, and clinical results. The combined bibliographic list of more than 500 titles considerably enhances the value of the work as a reference piece. A brief index to the entire volume is appended.

B. AUBREY SCHNEIDER

SOME CLINICAL APPLICATIONS OF ELECTRONEUROPHYSIOLOGY, ESPECIALLY ELECTRODIAGNOSIS AND ELECTROMYOGRAPHY.

Edited by Sidney Licht. Elizabeth Licht, New Haven. $10.00. xii + 272 pp.; ill. 1956.

In electrodiagnosis, a current is admitted to a muscle to evoke a contraction; in electromyography, the reverse occurs—a current is evoked from a muscular contraction. With suitable amplification and calibration, even the most minute electrical response from the body surface can be traced and measured for comparison of normal and pathological conditions. Research on and development of instruments and techniques have now achieved a high degree of reliability in the diagnostic and prognostic capacities of the devices available for use. Thus, precision instrumentation is replacing the all-too-fallible reliance upon gross clinical impressions in the field of neurophysiology.

The present volume represents the first major effort to bring together in a single treatise the relevant aspects of both electrodiagnosis and electromyography, as they apply to electroneurophysiology. In 12 chapters, prepared by as many specialists in the field and intended primarily for physicians, all the standard procedures and apparatus as well as those recently developed instruments for testing motor and sensory peripheral nerves, are discussed. Theory and observation are purposely interwoven in the procedure of interpretation; and a strong case is made for bringing physical medicine, both diagnostic and therapeutic, out of the laboratory of the technician and into the physician's office.

Abundant tabular and graphic materials are presented to demonstrate the wide variety of strength-duration curves and electromyographic tracings to be found in a large hospital practice; and charts illustrating the distribution of motor points, dermatomes, peripheral nerves, and segmental innervations contribute to a thorough knowledge of topographic neurophysiology. For further study, the physical therapist, neurologist, neurosurgeon, and any other practitioner who deals with peripheral nerve pathology, will find the extensive bibliographic lists a welcome source of reference.

Basic, yet enlightening, discussions of electroencephalography and electroretinography are appended. Indices of authors cited and of subject matter treated conclude the volume.

B. AUBREY SCHNEIDER

PREVENTIVE MEDICINE IN WORLD WAR II. *Volume II, Environmental Hygiene.*

Editor in Chief, John Boyd Coates, Jr.; editor for Preventive Medicine, Ebbe Curtis Hoff. Office of the Surgeon General, Department of the Army, Washington. $3.50. viii + 404 pp.; ill. 1955.

The subjects covered in this handsomely bound volume

of wartime medical history include food management, housing, water purification, waste disposal, control of insects, rodent control, the research background of insect and rodent control, foreign quarantine, and preventive medicine in ports of embarkation and for persons in transit. Three appendixes contain official documents relating to the control of respiratory disease by oiling floors and bedding, to the Interdepartmental Quarantine Commission, and to the Army Quarantine Program. There is an extensive index.

MODERN PUBLIC HEALTH FOR MEDICAL STUDENTS.
By I. G. Davies. Edward Arnold, London; [Williams & Wilkins Company, Baltimore]. $6.75. viii + 487 pp.; ill. 1955.

The history of the development of national health and welfare services in England is a rather fascinating chapter in the story of medicine and public health as it has unfolded around the world, and it is from this standpoint that the present volume probably can best be read and appreciated by its American audience. Although there is much here of a sound philosophy of public health, it is so completely oriented to, and interwoven with, the current body of British social legislation that it may not have a wide popular appeal to readers in this country. For a more precise definition of the book, the title should include the words "in England."

The volume opens with a definition of the nature and scope of public health which holds that the field encompasses not only such standard entities as disease, disability, nutrition, and living habits, but also the whole gamut of social disorders and maladjustments, such as crime, drug addiction, unemployment, illegitimacy, etc., which can be either cause or result of actual organic disease. It follows that correction must involve consideration of social as well as pathologic conditions. The author holds that specialization in the various fields of health and welfare has caused the medical practitioner to lose contact with the larger (national) concept of health, and that socialization will reestablish this contact without disrupting the intimate physician–patient relationship.

A large section of the volume is given over to a detailed account of the 21 separate acts of Parliament which constitute the body of legislation dealing with the various aspects of national health, welfare, and insurance. It is interesting to note that although 15 of these 21 acts have been passed since 1945, at least one group (the Lunacy Acts) dates from 1890.

The remainder of the volume is devoted to the discussion of the administrative structures, procedures, reporting forms, etc., necessary in the implementation of the medical service program in the country. Whether the discussion relates to mental health, school health, occupational health, or maternal and child health and welfare, there is careful orientation with respect to medical service and reporting from the standpoint of both qualification category (e.g., unwed mothers, deaf school children, the elderly infirm, etc.),and disability or disorder. The work is concluded with a 10-page index.

B. AUBREY SCHNEIDER

THE FIGHT FOR FLUORIDATION.
By Donald R. McNeil. Oxford University Press, New York. $5.00. x + 241 pp. 1957.

The fight for fluoridation is one of the most fascinating chapters in the history of public health. From its beginning in 1902, when Dr. Fred S. McKay became interested in the bizarre mottling of the teeth of some of his Colorado dental patients, through the slow-moving research which finally demonstrated in the mid-1940's the value of small amounts of fluorine in drinking water as a sound preventive measure in dealing with dental caries, and finally to the approval of fluoridation programs by the United States Public Health Service and the American Dental Association, and the subsequent hullabaloo of claims and counter-claims which we find daily in the public press, the story has taken many fantastic turns.

Proponents of fluoridation have found that the support of organized scientific opinion is no adequate match for the vociferous dissenters who quote quasi-scientific literature, the Constitution, and Holy Writ in support of their contention that fluoridation is "unpleasant, unnecessary, unscriptural, unnatural, unscientific, unconstitutional, unlicensed, unlawful, unprofitable, unhealthful, unjustifiable, and unpardonable." By 1955 the subject had been so completely divorced from public health, and had become such a political football, that in more than half the cities in which fluoridation was put to a popular mandate, it was defeated. One commentator has reported that in the past few years, the issue of fluoridation has had more effect in swinging elections than the qualifications of the opposing candidates for political office. This situation should help us evaluate the social "progress" which has been made since that day, in 1854, when John Snow was able to "remove the handle from the Broad Street Pump" (without putting it to a popular vote) and was thereby able to save half the city of London from the ravages of a cholera epidemic.

It is probable that no other historian has been as fortunate in respect to the sources and availability of his information as the author of this volume. All the major characters in the drama of fluoridation were still alive and available for consultation as the work was written. Much of their published work, their speeches, and their communications was intact and carefully

catalogued in a relatively few repositories. This "nearness" to the people and to the events gives the volume an extra measure of clarity and authenticity that is hard to find in a work of this type.

A list of some 360 references, a short essay on the sources, and an index conclude the volume.

B. AUBREY SCHNEIDER

ADVANCES IN EXPERIMENTAL CARIES RESEARCH. *A symposium presented on December 29, 1953 at the Boston meeting of the Amer. Ass. for Advancement of Sci.*

Edited by Reidar F. Sognnaes. American Association for the Advancement of Science, Washington. $6.75; AAAS members $5.75. x + 236 pp.; ill. 1955.

This is the "first monograph devoted specifically to the information gained from research on the experimental production and prevention of tooth decay in laboratory animals." Others besides dentists and pathologists will find much of interest and value in these papers, for genetic factors, developmental factors, dietary factors, salivary factors, endocrine factors, and the influence of antibiotics and other agents on experimental caries in rat, hamster, and some other mammals are given consideration. Contents: Production and evaluation of experimental animal caries: a review (E. Johansen & P. H. Keyes); Location of experimental caries on different tooth surfaces in the Norway Rat (R. M. Stephan & M. Rachel Harris); Genetic factors in experimental rat caries (H. R. Hunt, C. A. Hoppert, & S. Rosen); Developmental factors in experimental animal caries (J. H. Shaw & R. F. Sognnaes); Dietary factors in experimental rat caries (F. J. McClure); Salivary factors in experimental animal caries (W. G. Shafer & J. C. Muhler); Intra-oral effects upon experimental hamster caries (S. B. Fenn, C. E. Klapper, & J. F. Volker); Oral environmental factors in experimental rat caries (F. J. Orland); Influence of antibiotics on experimental rat caries (R. J. Fitzgerald); Effect of various agents on experimental caries: a résumé (J. W. Hein); General Summary (R. F. Sognnaes).

CHEMOTHERAPY OF MALARIA. *WHO Monograph Series No. 27.*

By Gordon Covell, G. Robert Coatney, John W. Field, and Jaswant Singh. World Health Organization, Geneva. $3.25. 123 pp.; ill. 1955.

This monograph, after some definition of terms and a discussion of the chemical and biological approaches to malaria chemotherapy, is devoted to a consideration of the individual compounds in common use, of drug-resistance in malaria, and of the problems arising in the clinical use of antimalarial drugs. Quinine, primaquine, mepacrine, chloroquine, proguanil, pyrimethamine, and related compounds are included. The publication was prepared too early to take into account the newer indications that resistance to malaria may relate to the inherited type of hemoglobin present in subjects and that this relation complicates the problems of drug-resistance and clinical use. Cross-resistance of the parasites to drugs exists but is held not to constitute a serious clinical problem.

THE BIOLOGIC EFFECTS OF TOBACCO, *with Emphasis on the Clinical and Experimental Aspects.*

Edited by Ernest L. Wynder; foreword by Joseph Garland. Little, Brown & Company, Boston and Toronto. $4.50. 215 pp.; ill. 1955.

Approximately thirty years ago, Lombard and Doering, in what is now a classic study, reported the results of their studies of the habits, characteristics, and environments of individuals with and without cancer. The outstanding facts established by those studies were that there were more non-smokers in the control group than in the lung cancer group and, inversely, that more heavy smokers were found among the lung cancer groups. Since then more data have been accumulated through retrospective (history-taking), prospective (follow-up), and time trend studies, all of which show a high correlation between lung cancer and cigarette smoking. From these studies, it appears safe to conclude that smoking is *one* of the causative factors in this disease. Evidence is also accumulating which appears to show, though not yet conclusively, that use of tobacco also significantly increases the risk of developing cancer at other sites—the mouth, tongue, or esophagus. Other, inconclusive studies indicate that tobacco adversely affects the cardiovascular system and longevity. Therefore, smoking, like eating and drinking, if not practiced in moderation, may unfavorably affect one's life.

Some questions raised by these studies are as follows: To smoke or not to smoke? What measures can be taken to reduce the risk of smoking? How effective are "effective filters?" What agent or agents in tobacco smoke are the carcinogens? Eight authorities contribute to this monograph in an attempt to answer some of these questions, but, even more, to point out possible ways of seeking such answers. Kosak deals with the chemistry of tobacco; Kensler, with its pharmacology; Batterman, with its effect on the gastrointestinal tract; Lowell, with its effect on allergy; McDevitt and Wright, with the cardiovascular system; Wynder, with neoplastic diseases; and Hammond, on biostatistical procedures, with cause and effect. The chapter by Hammond is especially excellent, and by itself is worth the cost of the book.

DAVID B. TYLER

ADVANCES IN CANCER RESEARCH. *Volume IV.*
Edited by Jesse P. Greenstein and Alexander Haddow. Academic Press, New York. $10.00. ix + 416 pp.; ill. 1956.

Volume 4 in the series brings up to date (1956) a review of the achievements in the fields of the chemotherapy of cancer, tumor immunity, the hormonal genesis of mammary cancer, and allied subjects. Although no chemical compound capable of producing a cure of cancer in man has yet been found, the therapeutic effects of a few chemical compounds are sufficiently encouraging to stimulate further study.

The contributors, from the United States and Europe, have been chosen for their command in their several fields. The book is full of information of value to any one interested in cancer research and is, therefore, an excellent reference book. Contents: Advances in Chemotherapy of Cancer in Man (S. Farber, R. Toch, E. M. Sears, and D. Pinkel); The Use of Myleran and Similar Agents in Chronic Leukemias (D. A. G. Galton); The Employment of Methods of Inhibition Analysis in the Normal and Tumor-Bearing Mammalian Organism (A. Goldin); Some Recent Work on Tumor Immunity (P. A. Gorer); Inductive Tissue Interaction in Development (C. Grobstein); Lipids in Cancer (Frances L. Haven and W. R. Bloor); The Relation between Carcinogenic Activity and the Physical and Chemical Properties of Angular Benzacridines (A. Lacassagne, N. P. Buu-Hoï, R. Daudel, and F. Zajdela); and The Hormonal Genesis of Mammary Cancer (O. Mühlbock).

This book is of great value, since it contains much information which could otherwise be obtained only by long perusal of the literature.

GRANT E. WARD

CYTOLOGIE DES WEIBLICHEN GENITALKARZINOMS. *Wiener Beiträge zur Geburtshilfe und Gynäkologie, Band II.*

By Edmund Schüller. Wilhelm Maudrich, Wien-Bonn. DM 24.–(paper); DM 26.50; $6.00 (cloth). vi + 129 pp.; ill. 1955.

The cytology of carcinoma of the cervix or fundus of the uterus or of other portions of the human female genital system is a very specialized field, and this monograph will therefore be of interest only to those specialists concerned with it clinically. The publication is richly illustrated with many halftone and 2 colorplates from the author's material.

EPILEPSY. *Grand Mal, Petit Mal, Convulsions.*
By Letitia Fairfield. Philosophical Library, New York. $4.75. 129 pp. + 4 pl. 1957.

Throughout the history of mankind, diseases of unknown or little known etiology have had a peculiar way of saddling sufferers from them with stigmata that no amount of sound enlightenment seems able to eradicate completely. It is the purpose of this excellent little volume (the American edition of a British publication) to set the public straight on the nature and significance of epilepsy.

Although the specific cause of epileptic seizures is still poorly understood, research continues to clarify the roles played by endogenous, as well as exogenous, factors and to develop more effective drugs for controlling attacks. The reader must remember, however, that the National Health Service and the Youth Employment Service, frequently referred to in the text as sources of assistance for handicapped people, are strictly British institutions that have no exact counterpart in the United States.

As a whole, this work is a plea for a more general social acceptance of the epileptic and for a more sympathetic understanding of his problems, both of which are essential if he is to emerge as a self-respecting and self-efficient member of society. The author's depth of discernment and simplicity in presentation should give patients a real opportunity to get their problems put into proper prospective. It should also enable the family, friends, and associates of epileptics to achieve the confidence and respect that sufferers need in order to lighten their overwhelming burden.

B. AUBREY SCHNEIDER

PSYCHOLOGICAL MEDICINE. *A Short Introduction to Psychiatry. Fourth Edition.*

By Desmond Curran and Maurice Partridge. E. & S. Livingstone, Edinburgh and London; [The Williams & Wilkins Company, Baltimore]. $5.00. viii + 407 pp. + 10 pl.; text ill. 1955.

Although this book is modestly entitled *A Short Introduction to Psychiatry*, it encompasses the entire range of psychopathologic entities usually subsumed under the heading of Psychiatry. It is apparently a popular textbook in England, the current edition constituting the 4th since its first issue in 1943. Originally written by Desmond Curran, Senior Consultant Psychiatrist to St. George's Hospital, this edition is the joint production of Curran and Maurice Partridge, the latter a consultant psychiatrist at the same institution.

It is quite remarkable to find that a psychiatric textbook published since World War II remains almost completely unaffected by the revolutionary contributions of dynamic psychology. This is a book that might well have been written fifty years ago. Simple and readable in style, it does not suffer from repetitive verbosity. Since it is based on "common sense" psychology and avoids all theories or complex metapsychological specu-

lation, it offers little difficulty for the beginner. There are a comprehensive chapter on case-taking, a good discussion of the post-concussal syndrome, and many sensible and practical diagnostic and therapeutic suggestions. The book may well appeal to people who, for one reason or another, find psychoanalytic concepts objectionable or unacceptable; and it will certainly help to counteract the dogmatism and excessive hypothesizing of certain psychoanalytic writers.

The fundamental proposition of this work is that most, if not all, psychiatric diseases have a variable physical and constitutional (hereditary) basis and that the psychological aspects are essentially reactions to, or elaborations of, the inherent predisposed pathology. The authors emphasize this point again and again. Thus, the schizophrenic syndrome is the "result of the operation of constitutional" factors; homosexuality and "psychopathic" personality are largely due to hereditary defects; "manic-depressive psychosis is a hereditary illness;" and even the neuroses occur in constitutionally weakened individuals. In short, there is a constant overemphasis of heredity and a marked tendency to minimize environmental or psychogenic factors. There is virtually a complete omission and denial of the existence and role of the unconscious and of the operation of psychic causality. The writers are peculiarly allergic to the word "dynamic" and see little value in projective psychological testing. Their discussion of mental mechanisms is superficial and incomplete. Psychological development and the evolution of the sexual and aggressive drives are barely touched upon, and the genetic influences of "bringing-up" are glossed over. Infantile sexuality is mentioned (toward the end of the book) only to be dismissed as a psychoanalytic invention. Surprisingly enough, there is a fairly accurate, but too brief, summary of Freudian thought, though it is safely insulated from the main body of the volume. It appears at the end of the book in a short discussion of psychotherapy.

One can also take issue with many specific ideas expressed by the authors. Anxiety, as a nosological entity, is seen to be a rare state. Hysteria is defined as a psychogenic condition that "serves some personal purpose." The entire discussion of neuroses is quite superficial, with the dynamics as largely conscious or subconscious. Psychosomatic disorders, according to the authors, have practically no psychogenic determinants, and therefore rightly belong to the medical practitioner. There is an almost total reliance on electrotherapy and insulin coma for the treatment of schizophrenic and affective disorders. I cannot agree with Curran and Partridge that involutional melancholia is closer to schizophrenia than to manic-depressive psychosis. There is a peculiar failure to mention hydrotherapy as a therapeutic modality, and psychotherapy in the treatment of the schizophrenic is dismissed as worthless and even harmful. Although this edition was completed in the summer of 1955, after Europe had been using ataractics for several years, the authors found little value in the use of these drugs, at a time when French workers and others were already indicating that the tranquillizing drugs, expecially chlorpromazine, were helping to revolutionize the treatment and management of psychotic patients.

Finally, the nosology of Curran and Partridge differs considerably from our own nomenclature. Simple and hebephrenic schizophrenia are classified under one heading. The term "hysteria" is retained as a major neurotic entity. The term "psychopathy" is used to signify antisocial character disorder. Psychophysiologic reactions are not considered, and borderline (schizophrenic) states are not even mentioned. In brief, there has been no attempt in this work to keep abreast of newer nosological concepts. For me, *Psychological Medicine* proved not to be a sound or comprehensive introduction to psychiatry.

M. STEINBACH

A HANDBOOK OF HOSPITAL PSYCHIATRY. *A Practical Guide to Therapy.*

By Louis Linn. International Universities Press, New York. $10.00. xxii + 560 pp. 1955.

This book, arising from seminars the author has held in various New York State hospitals, is designed to give new resident physicians a general account of the manifold activities of a hospital and to show the place of each member of the hospital staff in the total picture. The volume is divided into five parts: the Treatment Program; The Treatment Team; The Patients; The Hospital; and The Community. Linn is not content with a simple description of the hospital, the personnel, and the patients. He goes on to give detailed and extensive data about the most diverse aspects of the "hospital community," together with references to the most recent pertinent literature.

The book is full of sound observations. I know of no comparable source of information so vital to the young resident physician's early understanding of the hospital and of his place in it. This should be required reading for all residents.

WENDELL MUNCIE

DYNAMIC PSYCHIATRY, *in Simple Terms.*

By Robert R. Mezer; foreword by Harry C. Solomon. Springer Publishing Company, New York. $2.50 (paper). xii + 174 pp.; ill. 1956.

In the author's own words, "this book grew out of several years of lecturing to medical students and student nurses . . . and a feeling, purely personal, that psychiatry can be made understandable." The psychiatric resident who has to present psychiatry to student

nurses will profit from the book. It gives an oversimplified version—as the author puts it, he had "to get at the basic principles of what may be called 'dynamic psychiatry'." In this process psychiatry had to be stripped of the bewildering complexity of its problems, and many a statement will sound to a critical reader like dogmatic nonsense. Yet, whoever has tried to reduce the fullness of his own psychiatric knowledge so much that the average uninitiated mind can grasp it will respect the author's courage and not quibble about details.

WALTER O. JAHRREISS

THE PSYCHIATRIST AND THE DYING PATIENT.

By K. R. Eissler. International Universities Press, New York. $5.00. xiii + 338 pp. + 3 pl. 1955.

This book would be of little interest to biologists if it dealt only with the theme indicated by its title, but the author actually wanders into many fields: metaphysics, theology, ethics, esthetics, and biology; and the third part of the book contains a special chapter on Death and the Biological Sciences. "Death is also a problem of the mind; it may even be principally a problem of the mind and is possibly the foremost problem of the mind, but our thinking about death has been warped by biology, which must be called narrow at this point when compared with the vastness of psychology."

The author is one of the apparently few psychoanalysts who adhere to Freud's concept of a death instinct, who understand "death as a force which dominates life," and believe that "the goal of all life is discovered in death." Some support for this theory is found by the author in two other thanatologies of the twentieth century, one written by the biologist Rudolf Ehrenberg and the other by a philosopher, Martin Heidegger. How far Ehrenberg was actually influenced by Freud, as the author claims, I cannot say; but to assume that Heidegger's fundamental ontology, *Sein und Zeit*, was "written for the purpose of adjusting philosophy to Freud's conception" is rather naive.

The book reflects vividly the struggles of a man whose deep concern for humanity and for the individual forces him to come to grips with the age-old problem of dying. As he adheres to Freud's concept, it is not surprising that the subjective, life-immanent death (Heidegger's "Sein zum Tode," or Jasper's "Leben zum Tode") remains fused and at times confused with the life-transcending death, the end of a person's life, even though Freud considered the death instinct as a process within the living organism.

In the second part of the book we find the author's clinical contribution, so to speak; namely, three case histories. There the psychiatrist actually meets the dying patient. The problematics of three situations—fundamentally alike and yet quite different—are discussed. We read about the anxieties on both sides of the fence; about the psychiatrist's task of identifying himself with the dying person; and about transference and other facets of a psychiatric technique designed to help a person on his final path, so that he may crown the individualization process of his life by "dying his own death."

In the Concluding Remarks which make up the third part of this book, the author enlarges upon his special concern—the attempt to lay a psychological foundation of an orthothanasia, that is "a right, true, or proper manner of dying." It may be expected from this definition that orthothanasia cannot stand on psychology alone, but will stand in need of metaphysics and ethics also.

Euthanasia, for instance, is contrasted with orthothanasia. "The concept of Euthanasia implies the pleasure principle," and, the author states, "we are justified in trying to extricate the outlook on death from its scope, and to extend the reality principle to this necessity which dominates human existence! Orthothanasia is a dying in a manner adequate to the reality of death." It will therefore have to drop illusions which extend into the future, viz., the immortality of the soul, etc.

In the case of "the true martyr, euthanasia and orthothanasia coincide." In him "savoir mourir is only a particular aspect of savoir vivre." This situation the author accepts as valid also for the true Christian, especially for the devout Catholic. "Orthothanasia, though it has to destroy the comforting illusion of eternal life, restores death to a place which is free of evil and good. Death—though it cannot be integrated by the unconscious part of the personality, can be integrated by reason." Yet, some time will elapse before man can shed this illusion. "In all of us the archaic belief in the immortality of the soul is still dormant." Therefore, and in spite of his scientific convictions about orthothanasia, the psychiatrist "who is always in contact with the patient's unconscious, even when he is merely present, . . . must not waver in his conviction that the patient is ultimately immortal."

One wonders whether he understands Eissler's remarks correctly. The author at any rate realizes that the behavior of a psychiatrist who moves on such split-level ground must appear contradictory. But then the entire book is written by a man of imagination and supple intellect; and one could assume that, for this very reason, the author is a better therapist than theoretician.

WALTER O. JAHRREISS

MAGIC AND SCHIZOPHRENIA.

By Géza Róheim; posthumously edited by Warner Muensterberger; with the assistance of S. H. Posinsky;

foreword by Sandor Lorand. International Universities Press, New York. $4.50. viii + 230 pp. 1955.

The author is an anthropologist who interprets cultural and sociological data from the point of view of psychoanalysis. The first part of the book is devoted to an analysis of the origin and function of magic. All rituals are interpreted as representing magical ways of controlling the libido. Magical behavior operates neither on the pleasure principle (as is the case with fantasy) nor on the reality principle (as with effective realistic behavior). On the pleasure-reality continuum magic stands somewhere in the middle.

The universal resort to magic is a consequence of the prolonged dependence of the child upon his mother and his impotence in the face of frustration by her. Through magic the child brings back the mother and unites with her, so that she cannot leave him again. This is in essence the origin and function of all ritualistic behavior. The author draws upon his wide acquaintance with the customs of primitive peoples to illustrate these ideas.

The second part of the book is devoted to an examination of the fantasies and dreams of a hebephrenic patient whom the author interviewed periodically during 1½ years at Worcester State Hospital. Detailed excerpts from these interviews are reproduced and interpreted to show that the patient's fantasies represent a magical reunion with his mother, who had abandoned him in early infancy. However, the schizophrenic was unable to control the intense aggression which his early trauma had produced, so that ultimately he fails even in his role as a magician.

The last portion of the book is devoted to a brief analysis of *Alice in Wonderland* and some of Lewis Carroll's other works. In this analysis the author draws a parallel between these writings and schizophrenic fantasy.

To evaluate the validity of the theses presented by the author would involve a discussion of the premises of psychoanalysis as they are applied to personality theory and used in the interpretation of social phenomena. This is clearly not within the scope of a book review. For those who accept the basic tenets of psychoanalysis this book will be of interest. However, the book is not well written; its style is choppy, and the exposition is often unclear. This may be because the editors were reluctant to engage in much revision of the author's draft in arranging for posthumous publication.

SONIA F. OSLER

HEALTH CAREERS GUIDEBOOK.

Published by The National Health Council; supported in the public interest by The Equitable Life Assurance Society of the United States. Free to schools and counselors (paper). 156 pp.; ill. 1955.

Some 150 careers in public health are described in this pamphlet, with suggestions and discussions for high school students as to basic preparation, time required for education or special training, prospects for future employment, and sources of further information. The pamphlet should be of considerable value to high school counselors.

THE ZOONOSES IN THEIR RELATION TO RURAL HEALTH.

By Karl F. Meyer. University of California Press, Berkeley and Los Angeles. $1.00 (paper). iv + 49 pp.; ill. 1955.

SCHIZOPHRENER PROZESS UND SCHIZOPHRENE SYMPTOM-GESETZE. *Eine Prognostisch-Statistische Grundlagenstudie. Wiener Beiträge zur Neurologie und Psychiatrie, Band IV.*

By O. H. Arnold. Wilhelm Maudrich, Wien—Bonn. DM. 15; $3.76 (paper). vi + 86 pp.; ill. 1955.

THE MEDICAL SIGNIFICANCE OF ANXIETY.

By Richard L. Jenkins. The Biological Sciences Foundation, Washington. $1.00 (paper). iv + 46 pp. 1955.

PSYCHOLOGY AND ANIMAL BEHAVIOR

SOME ASPECTS OF REPRODUCTIVE BEHAVIOR IN THE BLACK-HEADED GULL (*LARUS RIDIBUNDUS RIDIBUNDUS* L.) AND RELATED SPECIES. *Behaviour, Supplement IV.*

By M. Moynihan. E. J. Brill, Leiden. 27 guilders (paper). x + 201 pp. + 5 pl.; text ill. 1955.

The scope of this monograph is quite restricted, but it constitutes a very detailed description and analysis of the reproductive behavior of *Larus ridibundus*, together with some comparative notes on the Silver Gull (*L. novae-hollandiae*), the Little Gull (*L. minutus*), and a few others. The ethological concepts and terminology are those of Tinbergen's group, and the monograph may be regarded as a documentation of those concepts and theories by means of numerous, painstaking observations. The aspects of behavior which are chiefly covered include "attack, escape, and other hostile behavior"; "early signs of pairing-behavior," essentially hostile; and "later stages of pairing," when hostility declines and Food-begging and Head-bobbing increase. In general, mutual attack and escape behavior are held to play a very strong part during the pairing activities.

OBEDIENCE TRAINING FOR YOUR DOG.

By Cecil Wimhurst; introduction by Blanche Saunders. Dover Publications, New York. 65 cents (paper). iv + 70 pp. + 32 pl. 1955.

A practical manual, very little concerned with dog psychology.

PSYCHOLOGY IN LIVING. *Third Edition.*

By Wendell White. The Macmillan Company, New York. $4.50. x + 317 pp.; 1955.

The two parts of this revised edition (2nd ed., *Q.R.B.*, 23: 87. 1948) deal with human relationships and mental health. The first part covers such topics as presenting one's ideas, interesting expression, inoffensive opposition to ideas, courtship, sympathy, and imitation, among others. Part Two describes general types of adjustment (in 8 pages), conflict and frustration, insolence and vanity, envy and jealousy, rationalization, and the like. In no sense can this book qualify as a textbook for any substantive field of psychology. It mainly gives advice and suggestions, and cites very little of the research literature. Though such a book may interest the general public and may do no harm, its value is questionable. Possibly, it may serve as a stimulus to direct the attention of a very unsophisticated audience towards some important problems of human life which might otherwise be ignored.

CHARLES N. COFER

SEX AND MARRIAGE.

By Allan Fromme. Barnes & Noble, New York. $1.50. xvi + 248 pp. 1955.

A reprint of a book published in 1950 under the title *The Psychologist Looks at Sex and Marriage*. Blunt explanation and advice, some of it commonplace, some of it less usual, all of it no doubt sound and valuable to a young couple just embarking on marriage.

EXPERIMENTAL PSYCHOLOGY. *A Series of Broadcast Talks on Recent Research.*

By A. J. Watson, Harry Kay, J. A. Deutsch, B. A. Farrell, Michael Argyle, and R. C. Oldfield; edited by B. A. Farrell. Philosophical Library, New York. $2.75. xii + 66 pp. 1955.

The topics discussed by these B.B.C. lecturers, in the respective order of their names in the list above, are as follows: Perception; Adult Learning and Remembering; Motivation; Some Hypotheses of Psychoanalysis; The Study of Social Behaviour; and The Prospects of Experimental Psychology. The treatment is not at all what would be called semipopular in the United States, and certainly nothing could be surer than that serious talks of this kind would never be offered on the American radio or television screen. They would not even qualify in style for the *Scientific American*. Yet no one ought to think them for that reason uninteresting. They are in fact even more interesting, since over and above their content they show what the serious British radio audience is accustomed to hear, and appreciates. As a collection, the 6 essays provide considerable scope and perspective, and may be recommended to biologists who want to know what new developments in experimental psychology are taking place.

BENTLEY GLASS

STOCHASTIC MODELS FOR LEARNING.

By Robert R. Bush and Frederick Mosteller. John Wiley & Sons, New York; Chapman & Hall, London. $9.00. xvi + 365 pp.; ill. 1955.

Well over half of this volume is devoted to the formulation and derivation of a mathematical model for the description of behavior change in relatively simple learning situations. The second part of the book summarizes applications of the model to several sets of experimentally obtained data, which fit the formula reasonably well. The model supposes that a subject in a learning situation has alternatives (usually two) of response available to him and that learning can usefully be described "as a flow of probability from one class of responses to another . . ." (p. 15). As the authors summarize it, "The basic elements of the mathematical system are a set of mutually exclusive and exhaustive alternatives $A_1, A_2, \cdots A_r$, a vector of probabilities $p_1, p_2, \cdots p_r$ with one component for each alternative, a set of mutually exclusive and exhaustive events $E_1, E_2, \cdots E_s$, and a set of operators $T_1, T_2, \cdots T_s$ corresponding to those events. The probability p_j $(j = 1, 2, \cdots r)$ represents the probability of occurrence of alternative A_j on a trial, and a trial is defined as an opportunity for choice among the r alternatives. When event E_i occurs, operator T_i is applied to the set of probabilities to yield a new set of probabilities" (p. 44).

Work of the type described by Bush and Mosteller has been developing in a number of places recently, but the new formulations do not very much resemble the familiar theories of learning. The mathematical development and sophistication of this model are at a much higher and more elegant level, but its variables (e.g., the Events) are relatively abstract and do not involve commitments to mechanisms. Thus, the writers take no side on such issues as reinforcement vs. con-

tiguity; they suggest that their model is compatible with either alternative. They offer their work as description, believing it will aid in the design of experiments and suggesting a number of advantages of their model over ordinary curve-fitting.

The book seems to be an impressive achievement. Despite the many derivations, much of it is eminently readable and can be followed with reasonably close attention. Its future impact on the study and theory of learning remains impossible to predict.

CHARLES N. COFER

INTELLIGENCE IN THE UNITED STATES. *A Survey—with Conclusions for Manpower Utilization in Education and Employment.*

By John B. Miner. Springer Publishing Company, New York. $4.25. xii + 180 pp. 1957.

In this book, Miner has formulated a theory based on research results obtained by psychologists over the past half century and substantiated, he feels, by recent findings of his own. The theory is based upon a concept of reasoning which "is probably the outcome of the prior development of complex learning sets to a point at which one trial learning is possible." Three variables are postulated for the functioning of intelligence in an individual: (1) native potential, defined as "a single, inherited potentiality for complex reasoning that resides in varying degrees in the neural structure of the human being"; (2) environment stimulus potential or exposure to the physical environment; and (3) motivation to learn. Special abilities are ascribed to "the channeling of a unitary native potential into certain content areas" by special interests and by characteristics of the environment to which the individual is exposed. The theory falls essentially within the category of theories that postulate intelligence to be a primary and unitary ability, rather than within the category of multiple-factor theories.

The statement of the theory is followed by a rationale for the use of vocabulary tests as perhaps the best measures of intelligence. Such tests are related to learning and reasoning ability, have high reliability, and correlate about as well with tests of intelligence as these more comprehensive tests correlate with each other. In 1953, an abbreviated vocabulary test (with previously reported reliability coefficients ranging from .83 to .915) was administered to a carefully stratified sample of 1500 persons, aged ten or over, in the United States. At the same time, a great deal of data was collected about each person through additional testing and interviewing. The test scores were then related to this other information, which included data on education, sex, occupation, race, rural-urban residence, religion, manpower utilization, etc. From this analysis, the author developed a number of conclusions.

One of the major conclusions is that those variables which are related to socio-economic stratification (viz., education, occupation, race, etc.) are the ones most consistently related to intelligence. Another conclusion is that the intelligence potential of the population of the United States is far from being utilized either in our educational system or in the occupational structure. The implications of these and other conclusions are discussed in terms of our national objectives.

Miner's analysis, for all its interest, scholarliness, and pertinence, has two weaknesses. The first concerns the use of a 20-word vocabulary test as a measure of general intelligence. It is difficult to believe that our methods for measuring and understanding intelligence are so advanced that we can sample the whole gamut of intelligence potential through such a device. The second objection is that the size of the sample is too small for generalizations of such wide scope. Miner takes cognizance of both of these objections, but states that since a more thorough approach will not be practical for a long time, it may be useful to make some estimates from the data now available. Since many of the conclusions of this study appear to be very reasonable, it is tempting to accept them as stemming from the data. From a scientific point of view, however, it would be preferable to accept the data exactly for what they are and what they suggest. The conclusions would more properly be considered hypotheses which require further study.

LUIGI PETRULLO

MEASUREMENT AND EVALUATION IN PSYCHOLOGY AND EDUCATION.

By Robert L. Thorndike and Elizabeth Hagen. John Wiley & Sons, New York; Chapman & Hall, London. $5.50. viii + 575 pp.; ill. 1955.

In a Preface, the authors say: "The general orientation of the book is practical. It is designed primarily for the person who is going to use or interpret tests, not for the person who is going to theorize about them." It seems to me that this purpose has been well realized. The book describes the history, philosophy, statistical concepts, desirable qualities, and objectives of tests; and it gives a good introduction to standardized intelligence tests, aptitude tests, achievement measures, and various techniques for appraising personality. Also discussed are teacher-made tests, marking and reporting, and the use of tests in guidance and in personnel selection. This is a solid and accurate textbook which can be highly recommended to anyone who would like a good introduction to the very important area of testing.

CHARLES N. COFER

PSYCHOLOGICAL TESTS AND PERSONNEL DECISIONS.
By Lee J. Cronbach and Goldine C. Gleser. University of Illinois Press, Urbana. $3.50. 165 pp.; ill. 1957.

In this small and very compact volume Cronbach and Gleser have developed some key elements in a new theory of testing based upon decision theory. Their frank objective, however, is to "stir up the reader's thoughts," rather than to present a complete theory.

In psychology and education much of the concern with problems of test development has long revolved around matters of measurement theory. Techniques of test construction, formulas for combining test scores, methods for obtaining optimum test reliability and validity, etc., have been of paramount importance. Cronbach and Gleser now point out that since there are other matters besides the accuracy of measurement which determine the value of a test, it is time to deal systematically with these problems—often more troublesome, but surely very crucial. One of the most important is the relevance of a psychological test to a particular personnel decision—such decisions as are involved when certain tests are selected for use in personnel selection and classification, in educational and vocational guidance, or the like; when test scores are used for the allocation of personnel to specific assignments; when optimum methods for test development are considered; etc. While not discarding the classic measurement theory from their decision model, and not ignoring other models such as the discriminant function and the Guttman qualitative model, they stress the superiority of their theory in heuristic value, flexibility, adequacy, etc.

The authors state that the application of decision theory to problems involving personnel decisions is bound to increase the utility of these decisions. The book tries to indicate how this may come about, and why it is so. The first two chapters are concerned with discussions of decision theory and its application to testing problems; the second chapter ends with a neat taxonomy of decision problems which leads to some 64 patterns or types of decision problems which may be involved in different testing programs. Much of the rest of the book is concerned with the individual treatment for several of the more important patterns. These are such problems as: (1) selection on the basis of a single test or composite score; (2) selection on the basis of sequential decisions; (3) placement decisions; or (4) decisions concerning optimum test procedures.

A very interesting chapter on the characteristics of decision problems is included. No attempt is made, of course, to present the whole of decision theory, but only those parts pertinent to a non-mathematical presentation as it applies to personnel decision problems. The application of decision theory to testing problems opens the way, the authors feel, to a systematic presentation of these problems. It gives more precise formulation to problems which have been inadequately expressed in the past; it brings into the open new problems which have been ignored for one reason or another; it suggests new solutions to old problems. Very wisely, since to do so preserves the continuity of the text, mathematical treatments of the problems dealt with are presented in a series of technical appendices.

A well-selected bibliography on test development and theory and on decision theory is included. One omission which was noted is that of Gullicksen's *Theory of Mental Tests* which is mentioned in the text as one of two classic presentations of traditional test theory, but which is, probably inadvertently, left out of the bibliography. This book is of such quality that a revised edition will undoubtedly be issued soon. If this is done, an index should certainly be added.

LUIGI PETRULLO

WORK, WORKERS AND WORK MEASUREMENT.
By Adam Abruzzi. Columbia University Press, New York. $7.50. xvi + 318 pp.; ill. 1956.

Today, thinking men in various fields are urging the development of new theories of behavior to combine the rational or systematic aspects of life with the so-called non-rational, emotional, or non-systematic aspects. In line with this approach, Adam Abruzzi attacks the industrial engineer's traditional concepts of work and of work measurement techniques, and claims that they are bound to fail, both theoretically and practically, because they are concerned with only one of two very important aspects of work. Followers of the classical tradition overlook the non-systematic aspects of work which, when ignored, lead to lower productivity.

The author's thesis and arguments are skillfully developed. He states that all work measurement techniques which ignore human values "fail to see that human behavior is purposive," that "purpose behavior must always include a non-standardized component in order to handle special situations." He believes that work has both systematic aspects and non-systematic aspects, and that "a theory of work must recognize that some (apparently) unproductive work activities are needed for optimal results." The refreshing thing about this theory is that it does not issue from an ivory tower. Abruzzi is an industrial engineer who has built his theory upon a large amount of experimental work in an industrial situation.

The book is divided into three parts. Part I, on the theory, practice, and fact of work measurement, is concerned with the nature of measurement and with problems of estimation and evaluation. Abruzzi claims that the confusion between estimation and evaluation constitutes one reason why classical work measurement procedures have failed. The second part of the book deals with the technical details of a work measurement

theory. Essentially material taken from *Work Measurement*, an earlier book by the author, it is a clear and detailed applied method based upon Abruzzi's theory of work. The third part, which develops a theory of the relationship between skill and fatigue, is perhaps the most interesting for the scientist who is not concerned with the technical aspects of work measurement. This section develops the thesis that all systematic work will eventually be done by machines, that "non-systematic work activity will be reserved for human beings, and will be external to direct production activity."

One can take exception to some aspects of Abruzzi's work, such as the statement that "social scientists . . . have made a fashion of flogging modern industrial technology and extolling the largely imaginary virtues of preindustrial eras." On the contrary, most social scientists do *not* have such an attitude. Time-study engineers receive even harsher treatment from the author for taking a diametrically opposite point of view. Here, too, is evidence that industrial engineers are beginning to be aware of the need for studying jobs not only in an industrial and economic setting, but in a cultural and psychological context as well. The total impact of the book is of such value, however, that its critical excesses can be excused. Modern industry, as well as modern human beings, would profit if some of Abruzzi's ideas were put into practice.

LUIGI PETRULLO

AN OUTLINE OF SOCIAL PSYCHOLOGY. *Revised Edition. By Muzafer Sherif and Carolyn W. Sherif; with a new introduction by Gardner Murphy. Harper & Brothers, New York.* $6.00. xx + 792 pp.; ill. 1956.

This volume is a considerably enlarged revision of the text published in 1948 by Sherif. Like the earlier volume, it adheres to the general orientation which has characterized the distinguished research and theoretical contributions of Sherif to social psychology for over twenty years. The fundamental idea is that all behavior occurs within a frame of reference established by the activities precedent to the current one. This position is rather faithfully adhered to, as the writers describe such topics as selectivity in attention and perception, effects of structures and unstructured stimulus situations, laboratory studies of social behavior, group formation, structure and function (their own research is effectively presented in connection with these topics), leadership and communication, social norms, intergroup relations, ego involvements, social attitudes and their formation, change and measurement, and the motives of man. Group prejudice, the effects of technology, reactions of men in critical situations, and an over-all view of social psychology, past and present, are some of the other subjects treated in the volume.

I am rather favorably impressed by the extensive topical coverage and the thorough documentation of this book. Most, if not all, of the standard social psychological topics are treated; and the reader is frequently reminded, through the consistent framework, of the essential continuity of the principles underlying social phenomena with those underlying even simple "asocial" laboratory events. I found the writing occasionally dull, but more often did not remember to note the style —in my judgment a good sign. As a systematic, comprehensive textbook, this book can be highly recommended.

CHARLES N. COFER

GREAT MEN. *Psychoanalytic Studies. By Edward Hitschmann; foreword by Ernest Jones; edited by Sydney G. Margolin with the assistance of Hannah Gunther. International Universities Press, New York.* $4.00. xiv + 278 pp. 1956.

This is a collection of articles written and published by the author in various psychoanalytic journals between 1912 and 1948. The papers deal respectively with Freud, Schopenhauer, Goethe, Eckerman, Samuel Johnson, Boswell, Brahms, and Swedenborg. A final chapter contains more than a dozen accounts of religious experiences of various people ranging from William James to an anonymous contributor to *Reader's Digest*.

In the introduction the author gives two reasons for applying psychoanalytic insights to the subjects of these papers: (1) "to comprehend the subject of the biography in terms of the dynamic forces of his developmental experience"; and (2) to study "the nature of the creative man and the creative process." These are large orders, and had they been carried out successfully, the book would have thereby fulfilled a third important function, that of providing a body of material illustrative of the psychoanalytic method of personality appraisal. The reader who approaches the book with such expectations is likely to leave it disappointed.

In the first place, the material is poorly organized. Not infrequently the reader becomes lost among an abundance of statements that follow one another in rapid succession without any continuity or logical relation. In several places large portions of material are repeated, almost verbatim and containing the same quotations and the same anecdotes. This type of thing might be understandable if the repeated material had appeared in different papers, originally published independently. But, regrettably, it occurs even within the same papers.

A more serious shortcoming, however, lies in the inconsistencies or even outright contradictions in assumptions and theoretical formulations which are made

from time to time throughout the book. Thus at one time the author states that "creative artists are productive through identification with their father who represents achievement through work." But in the case of Schopenhauer we find hatred and rejection of the father. Again, in connection with the personality of Goethe the reader is told, via a quotation from Freud, that "... he who is the undisputed darling of the mother retains throughout life that victorious feeling, that confidence in ultimate success which not seldom brings actual success with it." But in connection with Brahms Hitschmann states that while he was his mother's favorite, he nonetheless suffered from a profound sense of inferiority.

This last chapter well illustrates another characteristic of the entire book—circularity of reasoning. The main thesis of that chapter is that religious beliefs originate with an unresolved Oedipus complex and the concomitant ambivalence toward the father. Sixteen examples of profound religious experiences are presented, most of them quite brief, no longer than a page or two. In the majority little or nothing is known of the individual's early life; and the author therefore inserts a hypothetical description of what that individual's family relations might have been. Thereafter the author concludes that the regularity with which one finds an unresolved Oedipus complex in each of these cases amply demonstrates the soundness of this psychoanalytic principle. The reader who finds no time to read this book need not feel deprived.

SONIA F. OSLER

AN ELEMENTARY TEXTBOOK OF PSYCHOANALYSIS. *By Charles Brenner. International Universities Press, New York.* $4.00. ii + 219 pp. 1955.

The author intended "to provide a clear and comprehensive exposition of the fundamentals of psychoanalytic theory," and he has in fact succeeded. The small volume is excellently organized from a didactic point of view. It is well written and precisely formulated; and it guides the reader carefully through the widening stages, additions, and reformulations of Freud's fundamental concepts. The author wisely keeps away from metapsychological speculations.

How far the reader will agree with the material presented in this book will depend on his acceptance or rejection of the psychoanalytical theory, beginning with the "two fundamental hypotheses which have been abundantly confirmed ... the principle of psychic determinism, or causality, and the proposition that consciousness is an exceptional rather than a regular attribute of psychic processes."

WALTER O. JAHRREISS

ENERGY AND STRUCTURE IN PSYCHOANALYSIS. *By Kenneth Mark Colby. The Ronald Press Company, New York.* $4.50. xii + 154 pp.; ill. 1955.

The author of this small but significant volume is well known for his eminently readable and practical *Primer for Psychotherapists.* Yet this new book is neither easy to read nor immediately practicable. It deals with the highly abstruse, abstract, and speculative conceptualizations which psychoanalysis calls its metapsychology. The writer analyses the principles of this branch of psychoanalysis, introduces some valuable emendations and clarifications, and then proceeds to his principal contribution—the elaboration of a new theoretical model.

Freud employed a tripartite model of the id, ego, and superego to illustrate diagrammatically the structure of the psychic apparatus (PA), and used hydraulic ideas of his day to conceptualize the character of psychic energy. Colby contends that, since mathematics, physics, and engineering have advanced measurably since the 19th and early 20th centuries, a comprehensive conceptual model of the PA calls for an alteration of no inconsiderable proportions. He feels, moreover, that the tripartite model is oversimplified and inadequate to portray graphically the complex structure and dynamics of the PA, especially in the light of more recent advances in biological and psychoanalytic science.

The ideas of this book have been germinating in Dr. Colby's mind for many years, and tentative models of the psychic apparatus have undergone many alterations. Even now, he does not present his cyclic-circular model as a definitive schema. He offers his contribution in the hope that it will stimulate further theorizing and clarification in a field where much research is still needed.

In my own opinion, this is a truly remarkable work, whatever its ultimate fate may be; and its author is a truly unusual scholar who is conversant with philosophy, mathematics, physics, engineering, and psychoanalysis. Yet the reader will need a reminder that perseverence is rewarding—that a second reading will add much to one's understanding of the author's attractive ideas. Although one can scarcely expect this to become a popular book, it deserves careful study by all who are interested in psychological theory.

M. STEINBACH

THE INTERPRETATION OF NATURE AND THE PSYCHE. *I, Synchronicity: An Acausal Connecting Principle. II, The Influence of Archetypal Ideas on the Scientific Theories of Kepler. Bollingen Series, LI.*

By C. G. Jung and W. Pauli, respectively. Pantheon Books, New York. $3.00. viii + 247 pp. 1955.

In this volume, the founder of Analytical Psychology,

C. G. Jung, and Wolfgang Pauli, physicist and Nobel prize winner, are again working together towards the same goal, the possible integration of a scientifically mathematical way of thinking with another one to which not the quantitative relations of parts are essential but the indivisibility of the whole. In a more recent address, Pauli called such a synthesis of rational comprehension with the mystical experiencing of unity and wholeness "the explicitly formulated or tacitly implied Mythos of our time."

Whoever is not familiar with the concepts of a Collective Unconscious and of the Archetypes may find Jung's paper less difficult to read if he turns first to Pauli's article on the scientific theories of Kepler.

Johannes Kepler's ideas represent "a remarkable intermediary stage between the earlier, magical symbolic and the modern quantitative mathematical description." He was still able to contemplate the universe uno aspectu. "Religious meditations, an almost mathematical symbol of Trinity, modern optical theorems, essential discoveries in the theory of vision and the physiology of the eye, are all to be found" in one of his books, published in 1604. Kepler also speaks of preexistent ideas, implanted in the soul at the time of creation, primary images which the soul can perceive with the aid of innate instinct; and he calls them "archetypalis." Pauli stresses the "very extensive agreement" of these primary images with Jung's archetypes—"ordering operators and image formers in the world of symbolic images"—and he finds in them the "sought-for bridge between the sense perceptions and the ideas." They are "a necessary presupposition even for evolving a scientific theory of nature." Yet he warns against transferring this "a priori knowledge into the conscious mind and relating it to definite ideas capable of rational formulation."

The controversy between Kepler and the English physician and Rosicrucian Robert Fludd is scholarly recounted and well documented. It reads like the somewhat crude first edition of certain contemporary scientific skirmishes. Yet Pauli reminds us that the controversial attitudes of a quantitative way of thinking and a qualitative one can be traced throughout history, if they are seen in the perspective of a more general differentiation between "two types of mind," the thinking type (e.g., Kepler or Newton) as against the feeling type with an intuitive approach (Fludd or Goethe). To modern man, however, the only acceptable point of view appears to be "the one that recognizes both sides of reality—the quantitative and the qualitative, the physical and the psychical—as compatible with each other." Indeed, we should "embrace simultaneously the one process, devoted to adjusting our knowledge to external objects," and the other which "should bring to light the archetypal images used in the creation of our scientific concepts."

C. G. Jung, in his contribution to this volume, argues that modern psychology and parapsychology have proved that causality does not explain a certain class of events, and that in this case we have to consider a formal factor, namely, synchronicity, as a principle of explanation. In order to expound this "factor" and its empirical basis, Jung travels a long and winding road past Schopenhauer, Leibniz, and Albertus Magnus; through telepathy, alchemy, and astrology, to Heraclitus, the I Ching and the Chinese philosophy of Tao; and thence to Rhine's ESP experiments and to dreams. Jung first used the term "synchronistic" in a memorial address for Richard Wilhelm (1930): "The Science of the I Ching is not based on the causality principle, but on a principle which I have tentatively called the synchronistic principle." The simple, simultaneous occurrence of two events is called synchronism. Synchronicity, however, is defined as the coincidence in time of two or more causally unrelated events which have the same or a similar meaning. Furthermore, synchronistic events rest on the simultaneous occurrence of two different psychic states: the one is the normal, causally explicable state; the other, the critical experience, is that psychic state which cannot be derived causally from the first. Any attempt to explain synchronistic phenomena as mere chance would bring us into conflict with Rhine's ESP discoveries and other well-attested facts reported in the literature of parapsychology. For this reason, synchronicity, the interconnection of meaningfully coincident facts, must necessarily be thought of as "acausal." "However incomprehensible it may appear that an event, even remote in space and time could produce a corresponding psychic image when the transmission of energy necessary for this is not even thinkable, we are finally compelled to assume that there is in the unconscious something like an apriori knowledge of events, which lacks any causal basis." The almost simultaneous dream of the violent death of a friend thousand of miles away arose from an already existing unconscious knowledge of it. The effective ("numinous") potencies in the unconscious are the archetypes. Jung emphasizes that the synchronistic factor is not a philosophical view such as Leibniz's preestablished harmony, but an empirical concept, postulating a necessary principle which could be added as a fourth principle to the recognized triad of space, time, and causality. There are some cautious and cautioning remarks in this paper, but they cannot dim the author's conviction that he is on the right way toward a new conception of the unity of being; and that his theory of synchronicity as an acausal connecting principle is one possibility of getting rid of the incommensurability between the observer and the observed. Indeed, there are others, some of them mentioned in this article, who work toward the overcoming of the shackles of Cartesian philosophy.

Biologists may be interested in Jung's assumption that "we must completely give up the idea of the psyche's being somehow connected with the brain,"

and that "we are driven to the conclusion that . . . the sympathetic system . . . can evidently produce thoughts and perceptions as easily as the cerebro-spinal system." One must ask "whether dreams are produced not so much by the activity of the sleeping cortex, as by the unsleeping sympathetic system."

WALTER O. JAHRREISS

PSYCHOTHERAPY AND COUNSELING. *Ann. N. Y. Acad. Sci., Vol. 63, Art. 3.*

Edited by Roy Waldo Miner; consulting editor, Rollo May. New York Academy of Sciences, New York. $3.50 (paper). Pp. 319–432; ill. 1955.

There will be very little of interest to biologists in this collection of reports and papers except possibly the Findings of the Commission in Psychology, reported by N. Sanford, and dealing with the relations of psychology to psychotherapy; and the following brief comment by R. W. White on The Psychologist as Scientist.

HUMAN BIOLOGY

READINGS IN ANTHROPOLOGY. *McGraw-Hill Series in Sociology and Anthropology.*

By E. Adamson Hoebel, Jesse D. Jennings, and Elmer R. Smith. McGraw-Hill Book Company, New York, Toronto, and London. $5.00. xiv + 417 pp.; ill. 1955.

This anthology of selected materials is intended to represent the field of anthropology in its current development. There are eight parts, respectively entitled Anthropology, the Study of Man; Prehistory; Physical Anthropology and Race; Primitive Technology; Primitive Society; Language; Society and Culture; and Applied Anthropology. From the list it is apparent that the major part of the book is devoted to cultural anthropology rather than physical. This fact will make it of less interest to biologists than it might otherwise be, except for the general purpose of expanding one's cultural knowledge.

The sections devoted to physical anthropology—there is some in the section on Prehistory as well as the entire section that follows it—are disappointing, not alone in the matter of quantity, but also because of the selections themselves. It is not so much that anyone would find fault with what has been included, except for the seeming dominance of the Chicago group, but rather because the work and the views of so many outstanding physical anthropologists (Stewart, Schultz, Straus, Eiseley, Howell, Zuckerman, Lasker, and Spuhler, to name a few) have been omitted that the representation of the field seems biased and imperfect.

BENTLEY GLASS

THE CONTRIVING BRAIN AND THE SKILLFUL HAND IN THE UNITED STATES. *Something About History and Philosophy of History.*

By James C. Malin, Lawrence. $3.50 (paper). xii + 436 pp. 1955.

James P. Malin is a historian who has been greatly influenced in his philosophy of history and his treatment of the history of the United States by ecological and anthropological ideas. He consequently finds himself out of sympathy with the principal trends of historiography in this country, and vigorously attacks the subjective relativism of John Dewey, Charles Beard, and Carl Becker, and of their more recent disciples. Instead, Malin prefers what he calls "open-end," realistic modes of thought, as seen in George P. Marsh's nineteenth-century effort to view the relations of man and the earth ecologically, in E. W. Hilgard's geological and agricultural work on Mississippi, in H. A. Gleason's realistic concepts of plant associations, and in Carl Sauer's anthropogeography. The treatment of history may well be formulated in terms of an energy-power-work interpretation (as Carl Becker indeed thought of doing), or of a space-time-motion concept, or of the transformation of potentiality into actuality. By adopting in this way a philosophy of history that is realistic instead of relativistic and subjective, we may, Malin thinks, avoid the philosophies of extremes, the "Ideas of Progress, and of Malthusian doom, which have so largely dominated and contaminated Western thought since the eighteenth century."

Malin is a vigorous and constructive, if partisan, thinker. Not every biologist, any more than every historian, will agree with him. It is however clearly their loss if they ignore him.

BENTLEY GLASS

NATURAL SCIENCE OF SOCIETY.

By A. R. Radcliffe-Brown; foreword by Fred Eggan. The Free Press, Glencoe, & the Falcon's Wing Press. $3.50. xii + 156 pp. 1957.

This small volume contains addresses to a Seminar held at the University of Chicago in 1937, as recorded stenographically. The speaker had intended to revise it for publication, but at the time of his death had not done so. It is a safe prophecy that in the ranks of anthropologists and sociologists there will be much contention as to whether this little book packs a powerful wallop,

or is a balloon that will be considerably deflated by a few pin-pricks. As the author moves from Heraclitus to Durkheim, waving regards to logic, physics, chemistry and scientific method, one has a vision of a "daring young man on a flying trapeze." The exposition is lucid and pointed; and the expositor is never overcome with doubt about the correctness of his declamations. Briefly: a science of society is possible, but far from realized. It can be achieved only after a comparative study which utilizes the descriptions of all societies—(and which, of course, can never be, since many have perished from the face of the earth, and others will disappear before a Westerner can know them.) Much analogy is based on so-called illustrations from the natural sciences and mathematics. But one doubts that even in 1937 a physicist would agree that an atom remains the same even though an electron slips out of the atom and in again; or that mathematicians discovered the mathematical characteristic of parabolas by comparing them. Mere correlations, that is, associations, will not reveal causal factors. Of dicta there are many, some of them *obiter*. "A symbol is anything that has meaning." [This concept, unknown, I believe, in any discipline, certainly covers a multitude of sins and exposes few virtues.]

Again, "You cannot have a science of culture." "No science of culture is possible." The reason is: "culture cannot exist of itself even for a moment; certainly it cannot continue." [It would seem to follow that you cannot have a science of the heart; for the heart cannot exist—very long—of itself.] Of course, "Economics cannot be a separate theoretical social science"—and so we shall have to make shift without it.

Unfortunately, we do not know to what extent, or in what way, the author would have modified his statements before he consigned them to the printed page.

WILSON D. WALLIS

NAVAHO AND UTE PEYOTISM: A CHRONOLOGICAL AND DISTRIBUTIONAL STUDY. *Univ. Col. Studies, Series in Anthrop., No. 6.*

By David F. Aberle and Omer C. Stewart. University of Colorado Press, Boulder. $2.50 (paper). ix + 129 pp.; ill. 1957.

These scholars, tried and true, have done a meticulous and critical study, in field and library, of the inception and spread of the peyote cult among Ute and Navaho Indians. The cult was taken by a Dakota Indian to the Ute, from whom the Navaho in turn acquired it. A distribution study of Navaho groups which adhere to the cult, in percentage of individuals concerned, indicates that soon after the spread it was most permeating in groups near the Navaho source, but this did not apply to a later time period. As the authors summarize matters: "In analyzing cult distribution . . . it seems necessary to utilize both differential availability and differential appeal. If we use only the appeal factor, we may be attempting to explain differential cult intensities which are largely a matter of degree of exposure to the cult; if we use only availability, we may be attempting to explain differences which make sense largely in terms of appeal. Early in the process of transmission availability may be the principal factor; later, appeal may become prepotent. An examination of both elements must be attempted for the most satisfactory results." One chapter contains a history of the peyote cult in these two tribes.

WILSON D. WALLIS

VILLAGE AND PLANTATION LIFE IN NORTHEASTERN BRAZIL. *Monogr. Amer. ethnol. Soc.*

By Harry William Hutchinson. University of Washington Press, Seattle. $3.50. ix + 199 pp.; ill. 1957.

This monograph records a study of the life and activities of people in the village of Recôncavo, northeast Brazil, and nearby plantations on which sugar-raising is a major industry. It includes an account of African cults in the area and a description of the various social classes.

WILSON D. WALLIS

LE SOUDAN FRANÇAIS. *Pays africains, 5.*

By Georges Spitz; préface by Edmond Louveau. Éditions Maritimes et Coloniales, Paris. 700 fr. (paper). 111 pp. + 8 pl.; text ill. 1955.

This is another volume in the series devoted to descriptions of the French colonies in Africa. It is essentially a concise popular geography of the area concerned. Among the topics considered are: the natural features of the country, the people, the history, the political and administrative structure, social works, and economics. Anyone who is interested in this particular area can acquire a quick, comprehensive, and authoritative idea of it from reading this volume.

V. G. DETHIER

THE STONE AGE RACES OF NORTHWEST AFRICA. *Bull. Amer. Sch. Prehist. Res., [Peabody Mus., Harv. Univ. Bull.], No. 18.*

By L. Cabot Briggs; edited by Hugh Hencken. Peabody Museum, Harvard University, Cambridge. $3.00 (paper). vi + 98 pp. + 19 pl.; text ill. 1955.

A conscientious and meticulous study of "nearly all the available and reasonably complete cranial specimens

known to have been found in Northwest Africa," and classifiable as definitely "Neolithic or earlier," is presented here. The territory included extends from "the western frontier of Libya and the shores of Tunisia on the east to the Atlantic Ocean on the west, and from the Mediterranean on the north to the southernmost limit of the Sahara Desert."

The material is analyzed by localities, as well as in its entirety. The author finds, associated with Neolithic industries of the southern Sahara, "a very heavily negroid though seemingly basically Hamitic type, similar to some of the modern Fulah . . . and strong Negro influence . . . along the Moroccan coast as far north as Rabat" (p. 90). The southern negroid strain, he believes, "came into the western Sudan perhaps over 5,000 years ago." In this southern series, "the teeth are of good quality and seem in good condition, with no apparent traces of caries, abscesses or pyorrhea" (p. 77). In many of the skulls the left central incisor of the upper jaw had been knocked out during life. In both maxillae, "tooth eruption was complete with slight crowding, and the molars show a 4-4-4 cusp pattern." Variability of all skull dimensions is computed, and the skulls are "sexed."

WILSON D. WALLIS

AN ANTHROPOLOGICAL RECONNAISSANCE IN THE NEAR EAST, 1950. *Pap. Peabody Mus., Vol. XLVIII, No. 2.*

By Henry Field. Peabody Museum, Cambridge. $2.50 (paper). x + 119 pp. + 16 tables; ill. 1956.

Here is anthropometric information regarding specified groups in Iraq, Iran, Bahrein Island, and Saudi Arabia, and maps showing the locations of groups in Syria, Jordan, and Iraq. Appendices include: a Census (1947) and Surficial Area (1949) of Iraq; Bats Collected by the Expedition; Birds from [about 100 miles east of Palmyra] Syria; Cave Fauna.

There is a list of 65 medicines used in Dubei, near the Persian Gulf, with the Arabic name of each, but without a translation, or a botanical, or other identification, of the materials.

WILSON D. WALLIS

EXCAVATIONS IN THE QUETTA VALLEY, WEST PAKISTAN. *Anthrop. Pap. Amer. Mus., Vol. 45, Part 2.*

By Walter A. Fairservis, Jr. American Museum of Natural History, New York. $4.00 (paper). Pp. 165–402 + 27 pl.; text ill. 1956.

A profusely illustrated volume in which nothing desired is lacking. Dates of the various levels, as determined by carbon samples taken from charcoal deposits, range from 1650 B.C. to 5300 B.C., ±200–400 years. These early people "herded, or hunted, primitive oxen which may have been related to the aurochs," and "knew a more refined bovid, probably *Bos indicus*."

WILSON D. WALLIS

THE WESTERN-EDUCATED MAN IN INDIA. *A Study of His Social Roles and Influence.*

By John Useem and Ruth Hill Useem. The Dryden Press, New York. $3.00. xviii + 237 pp. 1955.

This team of writers, tested and attested in previous investigations, describes the reactions to their experiences abroad of men and women in India who had studied in the United Kingdom or the United States, and the reactions of compatriots to these same persons after their return home. The study was made during a single year, 1953–1954, in Bombay State; it includes life-histories of 110 men and women. About 13% of these people now hold administrative positions in government, 11% hold academic positions in colleges or universities, and 4% hold managerial posts in Indian-owned private enterprises. The authors conclude, "Perhaps only after another generation or more will it be possible to know the long-range effects of the foreign-educated on present efforts. As an isolated entity, the foreign-educated are insignificant; together with other groups they have the promise of converting India into one of the great nations of the modern world. . . . They will be important in preserving a nucleus around which a different order of life might be formed, for . . . it is clear that the country has an immense pool of human talent and a people who are convinced that its resources must be used to design a better life than has been known in the past. The future is too uncertain to forecast . . ." (pp. 130–131).

The report is incisive, sympathetic, critical, and objective throughout. The picture is sketched with illuminating detail and with ever-present appreciation of the larger setting.

WILSON D. WALLIS

ACCULTURATION. *Critical Abstracts, North America. Stanford Anthrop. Ser., Number Two.*

Edited by Bernard J. Siegel; assisted by Rose Wax. Stanford University Press, Stanford; Geoffrey Cumberlege, Oxford University Press, London. $4.00 (paper). xiv + 231 pp. 1955.

These abstracted monographs and journal articles extend through 1951, but the chosen base-line is not indicated, and there is no list of monographs and journals that were consulted. Abstracts are listed alphabetically by authors under monographs, and similarly under

journals. Section heads of each abstract follow the order: Purpose or Problem; Definitions, Assumptions, and Hypotheses; Methods and Techniques; Graphs and Charts; Data; and Conclusions. The announced aim of the volume is "to abstract all the major empirical studies reported by anthropologists in the setting of North America which are of importance in analyzing the processes of sociocultural change under conditions of cultures in contact." There is no classification by topic or area.

WILSON D. WALLIS

FROM GENERATION TO GENERATION. *Age Groups and Social Structure.*

By S. N. Eisenstadt. The Free Press, Glencoe. $6.00. 357 pp. 1956.

The author here offers a description and interpretation of age groups in selected parts of the primitive world and in some portions of the so-called civilized world. He makes frequent reference to practices based on seniority. In spots the book is difficult reading because of lapses into a jungle jargon sometimes called Parsonian, or by worse names.

"A strong predisposition for orientation to common values, and generally also a demand for a specific allocation of roles on the basis of age homogeneity and community of experiences, are also noticeable." Here is a real penchant for polysyllables; and in many instances, were Humpty Dumpty to lose his big words not much would be left of him. Some of these polysyllables, in their application, are new to social science.

Groups are acephalous, autocephalous, or heterocephalous, which seems to be equating the anatomist's "head" with every other kind of "head." But "headman" does not mean "a man with a head"; and a man who is "headstrong" does not necessarily have a strong head.

There are more typographical errors than a proofreader should let pass. Although a reader can usually make the necessary corrections in the text, they are not detectable in references unless one is familiar with the cited sources. The name of one author is given on p. 344 as *Agika*; a few lines below, as *Argika*. In the text a Nigerian tribe is the *Yako*; on p. 333 it is *Yakö*. *Raumm* (p. 331) *should be* Raum. *Schafera* (p. 349) *should be* Schapera, as on pp. 343 and 330. *Bas-com* (p. 333 *should be* Bascom, as given a few lines below. *S. Hall* (p. 339) is meant to be G. Stanley Hall. If an author has been cited previously, the citation refers the reader to the first citation, but gives him no inkling of where to find it. In many instances he must search through several pages of small print. The Tiv, who are referred to many times in these pages, are stated in two places to be in East Africa; the Notes show (correctly) that they are in Nigeria.

The Index leaves much to be desired. For example: the text devotes four pages to the Jewish *Kibbutz*, and nearly that much to the Russian *Komsomol*. Yet neither of these excellent accounts is referred to under those designations. The word *Kibbutz* is indeed there, but with a first reference to pages 177–178; and there is no reference to *Kibbutz* on p. 177. Under the last-mentioned word is *See also Family, Youth groups*. Under *Family* one finds: *in Kibbutz, 180, 249 ff*—but from p. 249 to the end of the text there is no reference to *Kibbutz*.

Komsomol does not occur at all in the Index. Under *Russia* there is mere mention of "evidence" (p. 178), and p. 285, where the reader can get no closer to Russia than ancient Greece. After discovering such discrepancies, I surrendered. Some circumstances justify what might seem to be cavilling.

WILSON D. WALLIS

PERINATAL MORTALITY IN NEW YORK CITY. *Responsible Factors. A Study of 955 Deaths by the Subcommittee on Neonatal Mortality, Committee on Public Health Relations, the New York Academy of Medicine.*

Analyzed and Reported by Schuyler G. Kohl. Published for The Commonwealth Fund by Harvard University Press, Cambridge. $2.50. xxiv + 112 pp. 1955.

The volume represents a report of a study of nearly 1000 perinatal deaths in infants weighing over 1000 grams. Incubator cases are therefore excluded. As such, the book is of interest to the house staffs of hospitals and to obstetricians, particularly since one of the major conclusions is that 35% of the deaths have been judged to be preventable.

ADAPTIVE HUMAN FERTILITY.

By Paul S. Henshaw. The Blakiston Division, McGraw-Hill Book Company, New York, Toronto, and London. $5.50. xiv + 322 pp.; ill. 1955.

Henshaw, in considering the problems brought on (or that may be brought on) by the current explosive rate of population growth, suggests a plan which he calls "teleogenesis." According to this plan, to have or not to have babies is to be left to the decision of individual couples themselves. Henshaw assumes that people will exercise objectivity and discretion in planning their lives and their family size. Like most idealists, he believes that the human species possesses the "ability to think logically and to act objectively in accord with rational conclusions." No compulsory methods of control are visualized. The success of such a plan depends upon man's better moments and upon suitable publicity.

The aim of the latter would be to extol and to idealize "responsible parenthood," which is defined as having only children that can be reared with pride and for whom a minimum standard of life during childhood can be provided; in other words, planning the family size in keeping with the means of support.

I do not agree with Henshaw that man is so capable of drawing rational conclusions or of acting logically or objectively. The very proof that he cannot lies in the plain fact that he lives with problems that would not exist if he were able to think, to act, and to draw conclusions logically, objectively, and rationally. I have stated before, and see no evidence to cause me to change my mind, that given a choice of high death rates or low birth rates, one can be sure man will vote for the latter—for the other fellow.

It is generally agreed that for any group in the population to maintain itself, approximately 2 to 3 children are required per fertile couple. The indications are, although of course there are not yet sufficient data to support this point, that the average couple want children in excess of that number. To be sure, there may be some isolated communities in which the desired family size is less; but in those areas where population density is a serious economic problem, it appears that the people want children in sufficient numbers to make population density an ever increasingly grave problem.

The results of recent studies indicate that an inexpensive, effective, and safe oral contraceptive ("contragestive," to be correct) will shortly be on the market. I am certain that this anticipated advance may make some aspects of life more palatable; nevertheless, I suggest that it is important to find out what family size is desired by the average couple. Such a survey, however, should be planned with great care, for conclusions drawn only from the answers of worn-out mothers with 6 to 10 children have as little bearing on the true state of affairs as those based only on the hopes of starry-eyed brides. It is understandable that some individuals in the latter group would like to give birth to and rear enough children for a basketball team (with substitutes), while the former want only an escape.

There are too many gaps in our knowledge, particularly of the basic causes for differences in birth rates among various peoples, to permit a simple solution to the problem. The results of studies to date indicate that the relationship between low protein intake and high birth rate is more casual than causal. In fact, if we were to interpret the findings of laboratory studies on animals as also applying to humans, it would appear that birth rates among the poor, malnourished masses of people in "have-not" countries should be the lowest, not the highest. Also, the statement ". . . conception, which has the opportunity of occurring after almost any coitus but actually occurs only about once for each 200 times . . ." (p. 220), raises a question—do couples in areas of high birth rates have intercourse more frequently, or are the chances of the occurrence of conception more favorable among these people? Nonetheless, this is a very good book, one of the most objective that I have read on this problem. Henshaw reviews most of the current demographic data and summarizes it so well that I highly recommend his book to the intelligent lay reader concerned with the current rate of population growth.

DAVID B. TYLER

POPULATION THEORY AND POLICY. *Selected Readings. Edited by Joseph J. Spengler and Otis Dudley Duncan. The Free Press, Glencoe.* $7.50. x + 522 pp.; ill. 1956.

This book presents, in a generally readable form, a series of lectures, essays, and articles from journals on various phases of population theory. Population theory, to judge by the selections in this volume, is not in a state of high refinement (if quantitation and predictive ability are to be taken as indices of refinement.) Among other questions, the articles collected deal with the following: What factors determine the rate of increase of a population? What mathematical generalizations and predictions can be made with respect to changes in population size? What constitutes an optimum population size? What is the relationship between degree of industrialization and birth rate? What attitude have governments taken, and what attitudes should or can they take toward overpopulation or underpopulation?

This field, in contrast to some others, is unencumbered by a morass of detailed experimental data; but it is somewhat overloaded with unsubstantiated verbal generalizations. That defect is singularly unfortunate, for the control of the rate of population growth is probably the most important socio-politico-biological problem of this century. Control of the skies, space, nuclear fallout, armaments, etc., are encompassing problems; but their long-term threat to the human race, its dignity and self-esteem, are subordinate to that of the almighty sperm and egg (of the same race).

This book divides the problem into 9 chapters, each of which contains 2 or more essays. The subject matter, however, appears to fall into 4 main categories: (1) population theory(s); (2) relations between population density and economic activity; (3) social effects of population density; and (4) population policy (i.e., the effect, or lack thereof, of governmental efforts to control fertility). Among the interesting general ideas discussed or developed are such as follow. The growth of human populations is not subject to any single law relating numbers of persons to space, food, etc. The upper limit of population density is that set by the food supply. A population tends to approach this limit under conditions which are not well defined, but which are generally associated with a preponderant backward agricultural economy. Populations tend to be in a condition of un-

stable equilibrium, once the hypothetical optimum density is passed—a sort of Cartesian diver effect.

Following the Industrial Revolution, the rate of population increase has tended to level off in those areas having a high degree of industrialization; and some, at least, of these nations may have reached stable values. In the underdeveloped areas, the introduction of public and personal hygiene has decreased the death rate, but has not relatively affected the birth rate. A further increase in population density has thus appeared in these areas.

In general, an overpopulated country is less capable than a more moderately populated one of rapid industrialization because (1) a greater percentage of the total population must be engaged in agricultural activities under marginal conditions, just to keep alive; (2) a high death rate before the productive age is reached uses resources and energy for individuals who do not return this investment to the society; (3) demands for full utilization of present productivity to satisfy present needs suppress the capital investment rate which is needed to increase overall productivity; and (4) a marginal agricultural economy is generally incompatible with the means for effective education in the means of achieving industrialization, agricultural abundance, and control of the birth rate.

Governments, it seems, are reluctant to institute measures for population restriction because of religious and social taboos, because population size and unrest are real factors in international diplomacy, because reproduction among humans is a statistical and not strictly predictive process, and because even dictators fear to hit below the belt.

The following selection by Kinglsey Davis, from *Population and Power in the Free World*, succinctly states the essential problem. "While the birth rate can scarcely rise above 65 per 1000 per year, the death rate can, with the proper lethal instruments, approach 1000 in a given area. It is therefore unsafe to assume that the world's population, or that of any particular region, will go on doubling every sixty to seventy years until we have untold billions. Indeed, it is strange to believe that the ingenuity and science necessary to make such population growth possible will not also be used in the relatively simple direction of controlling fertility. If men with all their science and technology are so irrational as not to control their fertility, they cannot be expected to be so wise as to use all of their increased capacities only for productive purposes."

BERNARD L. STREHLER

MUST MEN STARVE? *The Malthusian Controversy.* *By Jacob Oser. Abelard-Schuman, New York.* $4.50. 331 pp. 1957.

The author of this book attributes the poverty of the underdeveloped nations of the world to their exploitation by European and American commercial interests. Economic independence, combined with industrialization and improved agriculture, could, he maintains, greatly improve the living standards of India, China, and other densely populated areas. Since he has shown that there is no significant correlation between population density and poverty in the countries of the world, he assumes that underdeveloped, densely populated countries could escape malnutrition and poverty despite the population pressures.

Much of the poverty of Asia and Latin America is attributed to land tenure. Industrialization is recognized as essential to economic development; but to assume, as Oser does, that it could provide adequate food imports is unrealistic. It is true that some countries now have food surpluses; but the populations of such countries as the United States, Canada, Australia, and Argentina are growing rapidly and will need all the food they can produce. Oser criticizes wealthy nations for foreign investment policies that benefit themselves rather than their poorer neighbors. There has been exploitation, of course; but until the underdeveloped countries attain responsible governments, business interests are going to demand excessive profits for the excessive risks they must take. Even under ideal conditions it would be difficult, if not impossible, to increase food production more than 2 or 3 per cent annually for any significant period of time. Yet in many of the underdeveloped countries population increase is nearly 3 per cent per year. It should be obvious that no progress can be made unless food and industrial production increase faster than population. But land resources are limited.

The chapters on food production and new sources of food are optimistic. Food production could be doubled from existing cultivated acreage; and an additional 1.5 billion acres could be brought into cultivation, though at the risk of excessive cost. In any case, production will have to be increased very rapidly, since nearly two-thirds of the world's people are inadequately nourished and since, at the present rate of growth, the world population will double before the end of this century. Possibilities of new sources of food and energy are dealt with briefly and in an orthodox fashion; but the author has little apparent realization of the time required to perfect techniques, of the great amount of capital that would be needed, and of the time and effort necessary to educate illiterate populations for participation in a highly technical society.

Oser concedes that birth control has contributed to the economic development of much of the world, but he gives it a low priority. His violent opposition to the Malthusian doctrine is difficult to understand. Since Malthus did not approve of contraception and had little faith in continence as a means of birth control, he thought that poverty was inevitable and therefore justified. But some Malthusians have had the courage

to question the virtue of public health programs which, unless they include some control of the birth rate, can lead only to larger populations living in poverty. But the basic principles of the Malthusian laws are as valid today as they were in 1800. Population growth must be controlled either by high death rates or by low birth rates.

The problems of Puerto Rico are used to indicate the causes and remedies of poverty. The author does not consider a population density of one person per half acre of cultivated land as excessive. Instead, he attributes poverty to social problems. Birth rates remain high, but since 1940 the per capita income in Puerto Rico has increased 75 per cent while population has increased only 20 per cent. Much of the economic progress, however, can be attributed to indirect subsidies from the United States, while population growth has been tempered by mass migration to the states. Yet the author concludes that only social barriers prevent further progress! Oser effectively emphasizes social and economic problems in many respects, but the book does not justify Lord Boyd Orr's endorsement of it as "the most complete and detailed statement of facts on the subject yet published."

KARL SAX

BIOMETRY

PRINCIPLES OF MEDICAL STATISTICS. *Sixth Edition.* *By A. Bradford Hill. Oxford University Press, New York.* $4.00. x + 314 pp.; ill. 1955.

Few elementary treatments of statistics have met with greater favor than this one, which for clarity and practicality has long been recommended to medical students as a guide and standby. The new edition differs from the preceding chiefly by the addition of a new final chapter on Clinical Trials, together with a table of 10,000 random sampling numbers for use in experimental design. Biologists who are not acquainted with this excellent brief treatment of statistics will do well to compare it with such guides as Tippett's *Methods of Statistics* and *Statistics for Medical and Biological Students*, by Bernstein and Weatherall. British writers seem to excel in this field.

BENTLEY GLASS

MORTALITY AND OTHER INVESTIGATIONS. *Volume I.* *By H. W. Haycocks and W. Perks. Cambridge University Press, New York. Published for the Institute of Actuaries and the Faculty of Actuaries.* $4.00. x + 164 pp., ill. 1955.

This is a brief textbook designed as a part of the training of actuaries in the general theory and actuarial applications of statistics. It emphasizes principles and should be useful to demographers, to medical and biological statisticians, and to students of aging. Commencing with a consideration of one-year group mortality rates, it continues by treating such topics as analysis by age and duration since time of selection, combination of two or more years of experience, adjustments for entrants and leavers, sickness and other rates, principles of graduation, graphic exposition, interpolation in tables, and abridgment. A concluding chapter is devoted to the English Life Tables.

PSYCHOLOGICAL STATISTICS. *Second Edition.* *By Quinn McNemar. John Wiley & Sons, New York; Chapman & Hall, London.* $6.00. vii + 408 pp.; ill. 1955.

The first edition of this textbook met with the highest praise from the reviewer in this journal(*Q.R.B.*, 24: 180. 1949), and the book has since then been widely used. The current revision does not attempt to alter the fundamental character of the treatment. There has been some enlargement, especially of the elementary treatment of statistical inference. Large-sample and small-sample techniques are treated in separate chapters. More use has been made of the binomial distribution, both in the development of the logic of statistical inference and in the introduction to chi square. The second chapter on the analysis of variance has been considerably modified, so as to place more emphasis on the presentation of the underlying models and their implications for the proper error term. With these and other improvements, the textbook is certain to continue to enjoy popularity in its field.

HANDBOOK OF VITAL STATISTICS METHODS. *Studies in Methods, Series F, No. 7.* *Statistical Office of the United Nations, Department of Economic and Social Affairs, New York.* $2.50 (paper). iv + 258 pp. + 9 tables. 1955.

Everyone concerned with vital statistics will need to refer to this handbook of current methodology. The first chapter begins interestingly with a discussion of the Evolution and Present Status of Vital Records and Statistics, but it is all too brief. Most of the handbook is devoted to problems of registration and reporting, of compilation and tabulation, and the computation of rates and indices. Important among the "Annexes" is the full reproduction of the Principles for a Vital Statistics System, recommended by the Statistical Commission of the United Nations. Other appendixes contain a chronology of important events in the history of vital statistics; a definition of stillbirth according to

80 different geographic areas, as of 1950; and a selected set of references.

DE OMNIBUS REBUS ET QUIBUSDAM ALIIS

UNIVERSITY OF COLORADO STUDIES. *Series in Biology No. 3.*

Edited by Karl K. Hulley. University of Colorado Press, Boulder. $2.00 (paper). ii + 134 pp. + 6 pl.; text ill. 1955.

Included in this number is a paper by Creighton and Gregg on certain species of *Pheidole*, a formicid hymenopteran; one by Helwig, on spermatogenesis in an intergeneric grasshopper hybrid; one by Weber, on additions to the flora of Colorado; a paper by Williams, on the food of mice and shrews in a Colorado montane forest; and a final contribution, by Weber and Shushan, on the lichen flora of Colorado.

MODERN METHODS OF MICROSCOPY. *A Series of Papers Reprinted from* Research.

Edited by A. E. J. Vickers. Butterworths Scientific Publications, London; [Interscience Publishers, New York.] $3.50. iii + 114 pp.; ill. 1956.

The arsenal of the microscopist has been greatly enlarged in the last two decades, and the usefulness of his weapons in biological research has been such that no modern laboratory can afford to be without one or another of these major instruments. In fact, many laboratories tend to be built around instruments rather than around fields of biological interest, whether this practice is a sound one or not. *Research* has carried numerous articles dealing with the principles and applications of these instruments, and the editor of this journal has done a service in bringing them together in this brief volume. The types of microscopes considered include the following: electron, reflecting, fluorescence, phase contrast, flying spot, x-ray, and polarizing. Other papers deal with surface micro-interferometry, microscopic interferometry, metallurgical aspects of microscopy, and the numerical values and quantitative determinations which are possible and applicable to vegetable matter. This is an altogether handy and informative collection of papers.

C. P. SWANSON

RADIOCARBON DATING. *Second Edition.*

By Willard F. Libby. The University of Chicago Press, Chicago. $4.50. x + 175 pp.; ill. 1955.

The usefulness of the radiocarbon-dating technique, developed by Willard Libby, lies in the fact that it provides a means of time determination which is independent of all other considerations. Its value to geology, archeology, anthropology, and pollen analysis has been amply proved. The second edition of this standard work brings sampling and measurement improvements up to date and, in addition, provides data on a very large number of newly dated samples of various kinds and sources. Frederick Johnson's chapter, dealing with the significance of the technique to science in general, is an excellent essay well worth reading for its own sake.

C. P. SWANSON

THE PRESERVATION OF NATURAL HISTORY SPECIMENS. *Volume One. Invertebrates.*

Edited and compiled by Reginald Wagstaffe and J. Havelock Fidler; text figures drawn by Elizabeth M. Begg. Philosophical Library, New York. $10.00. xiv + 205 pp.; ill. 1955.

Many treatises on invertebrate phyla or subgroupings contain sections on methods of preserving and mounting specimens. In the present volume the authors have performed the invaluable task of collecting in convenient and well-organized form many of the standard and classical methods. The outcome is a book that every zoology laboratory will find extremely useful. Its chief shortcoming appears to be the lack of inclusion of the rapidly developing and extremely valuable methods of mounting in plastic. The techniques which are included are arranged in 21 chapters corresponding to invertebrate groups ranging from the Protozoa to the Tunicata. Five appendices deal respectively with apparatus and instruments, reagents, labels and labelling, storage, and microscopy. There is an ample index.

BIOLOGIA. *Vol. 1, No. 1. June, 1955.*

Editor-in-Chief, Sultan Ahmad. The Biological Society of Pakistan, Lahore. Annual subscription, Rs. 15; single copy, Rs. 8. 113 pp.; ill. 1955.

This new journal will be published twice a year. The contents of the initial number, which follow, indicate biological interests chiefly in morphology and taxonomy. Articles: Pezizales of West Pakistan (S. Ahmad); A new termite from East Pakistan (M. Ahmad); The imago of *Kalotermes beesoni* Gardner (M. A. Khan and M. Ahmad); A new spirurid (Nematoda: Acuariidae) from a hornbill (S. A. Akhtar); Two new genera of hypermastigote flagellates from the termite *Archotermopsis wroughtoni* (Desneux) (M. Saleem); The genus *Retortamonas* Grassi (Mastigophora: Retortamonidae) (M. A. R. Ansari); A contribution to the Charales of West Pakistan (M. A. F. Faridi); On the morphology of

scales in some teleost fishes (A. K. M. A. Haque); A new species of *Meliola* on *Butea monosperma* (Lam.) Kze. (A. Hafiz, Azmatullah and A. Kafi).

THE AUSTRALIAN MUSEUM MAGAZINE. *Vol. XII, No. 3, September 15, 1956.*

Edited by J. W. Evans. The Australian Museum, Sydney. Annual subscription, 8s. 6d.; single copy, 2s. (paper).vi + pp. 71–102; ill. 1956.

While it is not the custom of this journal to review the separate issues of established scientific periodicals, we do so in this instance in order to call attention to the fact that the *Australian Museum Magazine* has been reorganized under the directorship of Dr. John Evans. The new format is an attractive one, and the scope of the magazine is indicated by the inclusion in the present issue of articles dealing with fungi, birds, ancient insects, fossils, meteorites, eels, and coral.

BIBLIOGRAPHY OF MONOLINGUAL SCIENTIFIC AND TECHNICAL GLOSSARIES. *Volume 1: National Standards.*

By Eugen Wüster. UNESCO, Paris; (Columbia University Press, New York). $2.50 (paper). 219 pp. 1955.

Very little of a biological nature is listed in this bibliography, beyond the rules of the international commissions on botanical and zoological nomenclature and a few explanatory treatises on the rules. Only a single specialized dictionary, the *Zoologisches Wörterbuch* (Ziegler & Bresslau), is included. It would not be hard to double the length of the list by including works in English alone. In part, the omissions may be explained by the fact that the Universal Decimal System which is used has place only for "Botany" and "Zoology"—no biology in general, no microbiology, no overlapping sciences and subsciences.

BIOLOGICAL SCIENCES SERIAL PUBLICATIONS. *A World List 1950–1954.*

Prepared under the Sponsorship of The National Science Foundation by The Science Division Reference Department, Library of Congress. Biological Abstracts, Philadelphia. $2.00 (paper). viii + 269 pp. 1955.

This invaluable bibliographic list of 3,500 selected biological serial publications provides information in regard to titles, issuing agency or publisher, date of first issue, frequency of issue, and descriptive notes on nature of contents, language of text, presence of summaries in other languages, and other bibliographic data. The general list is classified into 5 main categories: General; Botany; Zoology; Science of Man; and General science publications containing contributions on biology. These are further subdivided into 64 subject categories. In addition the publication contains an Index of titles of journals, societies, and institutions, and a Subject Index. All in all, this world list includes what most people will find a need for. To have prepared a similar list for the total of 15,000 or 20,000 biological and partly biological periodicals in existence would require decades of labor, and the enormous final product might actually be less useful than this more selective publication. Editors, bibliographers, librarians, and biologists of all varieties owe a lasting debt to the National Science Foundation, the Library of Congress, and Raymund L. Zwemer and his staff for the successful completion of an enormous task.

BENTLEY GLASS

A REVIEW OF ACTIVITIES, 1930–1955.

The Josiah Macy, Jr. Foundation, New York. Free upon request. xiv + 174 pp. + 1 pl. 1955.

Established 25 years ago, the Josiah Macy, Jr. Foundation has created a unique place for itself among the numerous foundations which help to support medical research and education. The foundation was created by Mrs. Kate Macy Ladd, daughter of Josiah Macy, Jr., industrialist and banker after whom the organization is named. During its first quarter century of existence, the Macy Foundation has made an impressive contribution to the advancement of research and education in America.

One of the distinctive techniques devised by the Foundation is its conference program. By periodically bringing small groups of specialists together to discuss problems of mutual interest leisurely and in detail, this program has helped to break down the barriers raised between many branches of science by increased specialization. The resulting cross-fertilization of ideas has considerably influenced the growth of many of the fields covered in these conferences. The published reports of these symposia, which retain the informality and the give-and-take atmosphere of the gatherings, have become an important part of scientific literature.

In addition to the conferences, the Foundation has liberally supported investigators in a large number of fields, but especially in the basic sciences and in interdisciplinary problems. Though a full listing of all the areas and problems supported by the foundation is impossible here, a few are mentioned in order to indicate the nature of the whole program. Thus grants have been made for comparative studies on animal behavior, the endocrine glands, conduction of nerve

impulses, cardiovascular research, nutrition, cold and cold injury, and more recently, on nuclear physics. As a chapter in the continuing history of American medical research, this book is a useful contribution.

MORRIS C. LEIKIND

MEXICO. *Third Volume. Scientific Institutions and Scientists in Latin America.*

UNESCO, Montevideo. Free upon request (paper). ii + 76 pp. 1955.

Like the numerous other publications in this series, the aim of this one is to give information on the names, addresses, directors, dates of establishment, specific functions, officers, and recent publications of the scientific institutions of the country. This is a revision of the earlier list for Mexico. It includes 78 academies, associations, departments, schools, faculties of medicine or science, institutes, laboratories, societies, and universities. The publication is a photolith of a typescript and rather poorly reproduced. The language throughout is Spanish. In spite of its poor permanence of format, this and its companion publications are nonetheless important reference works and tools for the scientific librarian and bibliographer.

THE MIGHTY FORCE OF RESEARCH.

By The Editors of Fortune. McGraw-Hill Book Company, New York, Toronto, and London. $4.00. x + 308 pp.; ill. 1956.

Fundamental scientific research has found a staunch advocate in the collective person of the editors of *Fortune*. They're "sold" on it! A series of articles that originally appeared in the magazine between January, 1953, and August, 1955, shows why *Fortune* backs science. Labeling scientific research, both pure and applied, as the mightiest force in the United States at mid-century, it proves this thesis in a well-organized book, palatably packed with information that is predigested for easy absorption by the reader.

The first third of the book is devoted to a general description of the current state of research—the who, how, and why. The subsequent ten articles concentrate on specific key areas of research: man's brain, our water supply, the weather, new sources of energy, the automatic factory, among others. A useful index is included.

Certainly *Fortune* merits praise for its vanguard attempt to focus attention on a vital national dilemma: our reluctance to date, despite our obvious need for scientific superiority, to invest heavily in basic, noncommitted research, and to provide the intellectual climate essential for the development of scientific giants. One of the most interesting chapters in the book is the report on *Fortune's* study of a selected group of young, "name" scientists. The editors are rather dubious as to whether our present homogenized, conformist society can produce its share of strongly individualistic eggheads who will have a fierce streak of independence and a devotion to science because—"it's fun."

The book's scope recommends it to both the scientist and the layman. The section on specific areas of research might well have included a chapter on the notable contributions of biochemistry to medicine and on its potential contributions to the fundamental biological sciences of genetics and embryology.

THELMA S. NASON

SEXUALITY, LOVE AND IMMORTALITY.

By John P. Grip. Philosophical Library, New York. $3.50. 121 pp. 1956.

This book is the most complete mass of confusion I've seen in a long time. Sex, religion, and morality are chewed over for 121 pages; but the only conclusion which emerges—and then only foggily—is that human sexuality makes a lot of trouble in the world and that, in order to deal with this sad situation, everybody ought to become virtuous and religious—a prescription which has been recommended for hundreds of years with the most indifferent results. Many of the statements made are either so meaningless or so contradictory that a few random samples ought to be quoted. "The activities of the soul are a strain and a drain on the body. Too much strain can make a person insane" (p. 65). But the soul gets a better rating on p. 67, where we find that "The human body is something in the order of a battery which runs down and has to be recharged. Who does the recharging? *The soul.*" Astronomy (or perhaps relativity) gets passing mention on p. 85: "The earth is in space we say, but where in space is it?" That one is hard to answer! On p. 106 are some muddled metaphysics: "The low attracts, the high attracts also. The low attracts mass; that which is quantitative; the high is quality and attracts quality." On p. 72 we find that "Many sermons are such that there is no meaning in them to call for understanding." If this statement can be applied to the confused sermonizing of this book, I can agree whole-heartedly.

WALTER C. TOBIE

FRENCH DOCTORAL THESES. *Sciences, 1951–1953. French Bibliographical Digest.*

Edited and published by The French Cultural Services of New York. Free upon request (paper). viii + 75 pp. 1955.

GEOLOGICAL RECONNAISSANCE OF RAROIA (KON TIKI) ATOLL, TUAMOTU ARCHIPELAGO. *Bull. Amer. Mus. nat. Hist., Vol. 109, Art. 3.*

By Norman D. Newell. American Museum of Natural History, New York. $2.00 (paper). Pp. 311–372 + 27 pl. +1 folded map; text ill. 1956.

THE BEST SCIENCE-FICTION STORIES AND NOVELS: 1955. *Edited by T. E. Dikty with The Science-Fiction Year, by T. E. Dikty and The Science-Fiction Book Index, by Earl Kemp. Frederick Fell, New York.* $4.50. 544 pp. 1955.

THE OLD DIE RICH, *and Other Science Fiction Stories. With Working Notes and an Analysis of Each Story. By H. L. Gold. Crown Publishers, New York.* $3.00. vi + 250 pp.; ill. 1955.

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